Prepared for:
Shell Oil Products U.S., Inc.
Shell Martinez Refinery
3485 Pacheco Boulevard
Martinez, CA 94553



Trial Burn Report for CO Boiler No. 2

Final Report

ENSR Corporation
September 2006; Rev. 1 November 2006
Document No.: 05975-140-640

ENSR | AECOM

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Contents

List of Appendices

List of Tables

List of Figures

No figures provided in this report.

LIST OF ACRONYMS / DEFINITIONS

Acronym	Definition
acfm	Actual cubic feet per minute
AS	Alternate (Recovery) Standard
ASTM	American Society for Testing and Materials
BAAQMD	Bay Area Air Quality Management District
CARB	California Air Resources Board
CEMS	Continuous Emissions Monitoring System
CFR	Code of Federal Regulations
Cl_2	Chlorine gas
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COC	Chain of Custody
CVAAS	Cold Vapor Atomic Absorption Spectroscopy
DAS	Data Acquisition System
DI	Deionized (water)
DNPH	Dinitrophenylhydrazine
DOT	Department of Transportation (U.S.)
DRE	Destruction and Removal Efficiency
dscfm	Dry standard cubic feet per minute
dscm	Dry standard cubic meters
DTSC	Department of Toxic Substances Control (California)
EPA	Environmental Protection Agency (U.S.)
ESP	Electrostatic Precipitator
g/hr	Grams per hour
GC	Gas Chromatography
GC / MS	Gas Chromatography / Mass Spectrometry
GRAV	Gravimetric
gr/dscf	Grains per dry standard cubic foot
HCl	Hydrogen Chloride
HPLC	High Performance Liquid Chromatography
HRA	Hourly Rolling Average
HRGC / HRMS	High Resolution Gas Chromatography / High Resolution Mass Spectrometry
ICP / MS	Inductively Coupled Plasma / Mass Spectrometry
INST	Instantaneous
IS	Internal Standard
lb/hr	Pounds per hour
LCS / LCSD	Laboratory Control Sample / Laboratory Control Sample Duplicate
Lpm	Liters per Minute

Acronym	Definition
MACT	Maximum Achievable Control Technology
MCB	Monochlorobenzene
MDLs	Method Detection Limits
mg/dscm	Milligrams per dry standard cubic meter
mg/kg	Milligrams per kilogram
MS / MSD	Matrix Spike / Matrix Spike Duplicate
ND	Not detected or non-detect
NELAC	National Environmental Laboratory Accreditation Conference
OMA	One Minute Average
OPR	Ongoing Precision and Recovery (study)
O_2	Oxygen
PAHs	Polycyclic Aromatic Hydrocarbons
PCDDs/PCDFs	Polychlorinated dibenzo-p-dioxins/polychlorinated dibenzofurans
PICs	Products of Incomplete Combustion
PM	Particulate Matter
POHC	Principal Organic Hazardous Constituent
ppm	parts per million
PS	Pre-spike (recovery standard)
QA/QC	Quality Assurance/Quality Control
RAC	Reference Air Concentration
RCRA	Resource Conservation and Recovery Act
RL	Reporting Limit
RPD	Relative Percent Difference
RsD	Risk Specific Dose
SMR	Shell Martinez Refinery
S/N	Signal to Noise Ratio
SVOCs	Semivolatile Organic Compounds
SOP	Standard Operating Procedure
STL	Severn Trent Laboratories
TBP	Trial Burn Plan
TEF	Toxic Equivalency Factor
TEQ	Toxic Equivalency
THC	Total Hydrocarbons
TICs	Tentatively Identified Compounds
TX / TX-C	Tenax / Tenax-Charcoal
VOCs	Volatile Organic Compounds
VOST	Volatile Organic Sampling Train

1.0 Trial Burn Emissions Summary

The Shell Martinez Refinery (SMR) in Martinez, CA conducted RCRA Trial Burn testing on one of its carbon monoxide (CO) boilers during the weeks of June 5 and June 12, 2006. Trial burn testing was performed on CO Boiler No. 2 (COB-2) in response to requests from the California Department of Toxic Substances Control (DTSC) and the Bay Area Air Quality Management District (BAAQMD). The test was conducted in accordance with an approved Trial Burn Plan (TBP) and under full oversight of the DTSC. Test parameters included both regulated emissions and/or performance standards called out in the facility's RCRA permit as well as non-regulated parameters of interest to a multipathway human health risk assessment. Further details on the overall scope and objectives for the trial burn are provided later in Section 2.2.

An overall summary of emission results and/or performance criteria for currently regulated parameters is provided in **Table 1-1**. In addition, a comparison is provided in **Table 1-2** of applicable emission data to the MACT standards that will affect the Martinez refinery in the future and will be under the jurisdiction of BAAQMD.

It is noted that the DRE test conducted during Test Condition 3 did not achieve the minimum required performance standard of 99.99% destruction / removal efficiency. The causes for this are currently under investigation and a retest will be performed as soon as practicable. An addendum to this report will be issued following the completion of a successful retest. All other test parameters for the trial burn complied with both current permit limits and future MACT standards.

Table 1-1 Trial Burn Emissions Summary for Currently Regulated Constituents

Emission Parameter and Sampling Method	Units	Test Average [(a)]	Current Permit Limit
POHC DRE (Method 0030) --			
Monochlorobenzene	%	99.9638	> 99.99
PM / HCl / Cl_2 (Method 0050) --			
Particulate Matter @ 7% O_2	gr/dscf	0.0046	0.08
Hydrogen Chloride	g/sec	0.065	18.3
Chlorine	g/sec	0.015	1.05
Metals (Method 29) --			
Antimony	g/sec	< 3.11E-06	7.60E-02
Arsenic	g/sec	2.07E-05	6.77E-05
Barium	g/sec	2.30E-05	6.00E-01
Beryllium	g/sec	< 6.65E-06	6.77E-05
Cadmium	g/sec	4.45E-06	4.60E-04
Chromium	g/sec	4.43E-05	6.00E-04
Lead	g/sec	3.43E-05	7.40E-02
Mercury	g/sec	1.61E-04	5.60E-02
Silver	g/sec	7.89E-05	5.10E-01
Thallium	g/sec	< 6.65E-06	7.60E-02
Facility CEMS --			
Carbon Monoxide	ppm	13.4	100

[(a)] DRE data are reported for Condition 3; all other results are from Condition 2.

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Table 1-2 Trial Burn Emissions Compared to Future MACT Standards

Emission Parameter	Units	Test Average [a]	Future MACT Limit [b]
Destruction and Removal Efficiency			
Monochlorobenzene	%	99.9638	> 99.99
PCDDs/PCDFs			
Toxic Equivalents (TEQs)	ng/m³	1.3E-05	0.40
Particulate Matter and Halides --			
Particulate Matter	gr/dscf	0.0046	0.035
Hydrogen Chloride & Chlorine	ppm	0.83	31
Metals --			
Mercury	µg/m³	2.92	19
Cadmium, Lead & Selenium	µg/m³	40.3	150
Arsenic, Beryllium, Chromium, Antimony, Cobalt, Manganese & Nickel	µg/m³	4.59	370
Facility CEMS --			
Carbon Monoxide @ 7% O_2	ppm	13.4	100

[a] DRE data are reported for Condition 3; all other results are from Condition 2.

[b] Final MACT standards for liquid fuel-fired boilers were published in the Federal Register on October 12, 2005. See 70 FR 59402, Section 63.1217.

Note: All emission data are corrected to 7% oxygen.

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2.0 Introduction

2.1 Project Background and Schedule

Shell Oil Products operates three CO boilers that burn RCRA-designated hazardous waste at its refinery in Martinez, CA. These boilers are identified as COB-1, COB-2 and COB-3. Shell responded to Agency requests requiring the submission of an updated RCRA Part B Application, including a TBP. The Trial Burn test was conducted in accordance with the approved TBP, Revision 2, dated November 2005.

Trial burn testing was performed over the June 5-14, 2006 time period. A total of three operating conditions (triplicate runs per condition) were evaluated over the course of this program:

- A low ESP power test (Condition 1) was completed on June 6;
- A normal process operation test (Condition 2) was completed on June 7, 8 and 9; and
- A low temperature test (Condition 3) was completed on June 13.

The overall trial burn schedule is depicted through detailed summaries of the various sampling train run times in **Tables 2-1 and 2-2**. Table 2-1 shows the run times associated with all sampling trains for the entire program. Table 2-2 provides the times for the "overall" run period defined as the duration from the start of the first sampling train to the end of the last sampling train. These overall run periods were used to generate the minimum, maximum and average values for the process data collected by Shell and to also provide an overall run average for the spiked organic constituent during Test Condition 3.

2.2 Project Scope and Test Requirements

The trial burn test program had several objectives to fully meet all regulatory requirements. First, the testing was intended demonstrate the ability of the combustion system to meet the emission and performance standards called out in the facility's permit. The primary objectives were to:

- Conduct a Trial Burn as required by Section V.F.2 of the facility's permit;
- Demonstrate that the CO Boilers comply with the applicable emission standards and operating limits (performance standards) outlined in Section V.C.3 of the facility's permit; and
- Revise certain operating limits as presently outlined in Section V.C.3 of the facility's permit.

A secondary objective of the trial burn was to develop data on stack emissions for use in updating the facility's health risk assessment. In order to achieve all program objectives, the trial burn was conducted under three distinct operating conditions as described earlier. These test conditions are described in more detail in Section 3.1 of this report.

2.3 Report Organization

This report is organized in a manner that should facilitate review of all results and supporting documentation. Section 1.0 summarized emission results for key parameters and Section 2.0 provides a brief narrative concerning the project background, schedule and scope. Section 3.0 provides detailed information on process operating conditions and facility monitoring data and summarizes expectations regarding future regulatory-imposed permit limitations based on test results. Section 4.0 presents an overall summary of the trial burn sampling methodologies employed while Section 5.0 presents detailed results for the trial burn test program. Finally, Section 6.0 outlines applicable QA/QC measures implemented during both the field and analytical

portions of the program to ensure valid data. Appendices provide all pertinent supporting documentation including:

- Facility process monitoring data (Appendix A);
- The report on field sampling activities prepared by The Avogadro Group, LLC (Appendix B);
- The POHC spiking report prepared by Triad Chemicals, LLC. (Appendix C);
- Field sampling data sheets and related documentation provided by ENSR (Appendix D); and
- Analytical data reports provided by each subcontractor laboratory (Appendix E).

Table 2-1 Trial Burn Sample Train Run Times

Run #	Date	PM	
		Start	Stop
C1-R1	06-Jun-06	09:30	11:40
C1-R2	06-Jun-06	12:45	14:57
C1-R3	06-Jun-06	15:30	17:40

Run #	Date	Aldehydes	
		Start	Stop
C2-R1	07-Jun-06	10:00	13:40
C2-R2	08-Jun-06	13:15	15:50
C2-R3	09-Jun-06	13:10	15:35

Run #	Date	Metals	
		Start	Stop
C2-R1	07-Jun-06	10:00	13:40
C2-R2	08-Jun-06	13:15	15:50
C2-R3	09-Jun-06	13:10	15:35

Run #	Date	PCDDs/PCDFs/PAHs	
		Start	Stop
C2-R1	07-Jun-06	16:22	19:35
C2-R2	08-Jun-06	08:00	11:10
C2-R3	09-Jun-06	08:00	11:54

Run #	Date	VOST - Condition 2	
		Start	Stop
1A	07-Jun-06	16:50	17:10
1B	07-Jun-06	17:30	17:50
1C	07-Jun-06	18:00	18:20
1D	07-Jun-06	18:28	18:48
1E	07-Jun-06	18:58	19:18
2A	08-Jun-06	08:40	09:00
2B	08-Jun-06	09:04	09:24
2C	08-Jun-06	09:30	09:50
2D	08-Jun-06	10:00	10:20
3A	09-Jun-06	09:40	10:00
3B	09-Jun-06	10:08	10:28
3C	09-Jun-06	10:38	10:58
3D	09-Jun-06	11:06	11:26

Run #	Date	PM / HCl / Cl_2 / NH_3	
		Start	Stop
C2-R1	07-Jun-06	10:00	13:40
C2-R2	08-Jun-06	13:15	15:50
C2-R3	09-Jun-06	13:10	15:35

Run #	Date	Hex. Chromium	
		Start	Stop
C2-R1	07-Jun-06	10:00	13:40
C2-R2	08-Jun-06	13:15	15:50
C2-R3	09-Jun-06	13:10	15:35

Run #	Date	SVOCs	
		Start	Stop
C2-R1	07-Jun-06	16:22	19:35
C2-R2	08-Jun-06	08:00	11:10
C2-R3	09-Jun-06	08:00	11:10

Run #	Date	VOST - Condition 3	
		Start	Stop
1A	13-Jun-06	10:30	10:50
1B	13-Jun-06	11:12	11:32
1C	13-Jun-06	11:44	12:04
1D	13-Jun-06	12:15	12:35
2A	13-Jun-06	12:55	13:15
2B	13-Jun-06	13:28	13:48
2C	13-Jun-06	14:02	14:22
2D	13-Jun-06	14:39	14:59
3A	13-Jun-06	15:16	15:36
3B	13-Jun-06	15:50	16:10
3C	13-Jun-06	16:23	16:43
3D	13-Jun-06	16:55	17:15

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Table 2-2 Overall Trial Burn Run Times Associated with Process Data Collection and MCB Spiking

Run #	Date	Overall	
		Start	Stop
C1-R1	06-Jun-06	09:30	11:40
C1-R2	06-Jun-06	12:45	14:57
C1-R3	06-Jun-06	15:30	17:40

Test Condition 2

Run #	Date	Overall	
		Start	Stop
C2-R1	07-Jun-06	10:00	13:40
		16:22	19:35
C2-R2	08-Jun-06	08:00	11:10
		13:15	15:50
C2-R3	09-Jun-06	08:00	11:54
		13:10	15:35

Test Condition 3

Run #	Date	Overall	
		Start	Stop
C2-R1	13-Jun-06	10:30	12:35
C2-R2	13-Jun-06	12:55	14:59
C2-R3	13-Jun-06	15:16	17:15

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3.0 Process Operating Conditions and Compliance Strategy

3.1 Overview of Test Conditions

The three operating test conditions evaluated during this program consisted of a low ESP power test (Condition 1); a normal operation test (Condition 2) and a low temperature test (Condition 3). The specific objectives for each of these conditions were:

Low ESP Power Mode (Test Condition 1) --

- Establish the minimum power input to the electrostatic precipitator (ESP).
- Conduct testing for particulate matter (PM) and total hydrocarbons (THC).

Normal Operations Mode (Test Condition 2) --

- Not used to establish any new or revised operating limits.
- Conduct a variety of testing to support the health risk assessment update. Testing performed for polychlorinated dibenzo-p-dioxins / polychlorinated dibenzofurans (PCDDs/PCDFs); polycyclic aromatic hydrocarbons (PAHs); carbonyl compounds (aldehydes); volatile and semivolatile organics (VOCs and SVOCs); metals; hexavalent chromium; PM; hydrogen chloride (HCl); chlorine (Cl_2); ammonia (NH_3) and THC.

Low Temperature Mode (Test Condition 3) --

- Establish the minimum firebox temperature, maximum waste feed rate, minimum waste feed atomization pressure and maximum firebox pressure.
- Spike MCB into the waste stream to demonstrate the system's ability to meet the DRE requirements of 99.99%.
- Conduct sampling for MCB and THC along with concurrent measurement of stack gas flow.

3.2 Facility Monitoring Data

Throughout the trial burn, detailed process information was collected continuously by the facility's process control computers and data acquisition system (DAS). **Tables 3-1 through 3-3** provide summaries of process data including minimum, maximum and average values for key process variables recorded during each test condition.

Specific parameters reported in Tables 3-1 through 3-3 including the time basis for the measurement are outlined below. Supporting documentation including all one-minute averages (OMAs) throughout each trial burn run period is provided in **Appendix A**. In general, target operating conditions specified in the trial burn plan were achieved.

Parameter	Tag ID #	Units	Measurement Basis (a)		
			Instant.	OMA	HRA
Waste Feed Rate	F2672AVG	gpm			X
Waste Feed Atomization Pressure	9PDI1565 9PDI1566	psig	X		
Firebox Temperature	T3182AVG	°F			X
Firebox Pressure	P1725AVG	in. w.c.			X
ESP Power	9EI2673	kVa	X		
Stack Gas Flowrate	9FI1596	in. w.c.	X		
Stack Gas Flowrate (calculated)		scfm	X		
CO Concentration at 7% Oxygen	A2642AVG	ppm			X
Oxygen Concentration	9AI2611	%		X	

3.3 Data-in-lieu-of Testing

For this program, Shell conducted trial burn testing on one unit (COB-2) and is using data-in-lieu-of to establish limits on the other two units (COB-1 and COB-3).

3.4 Anticipated Permit Conditions

On the basis of the trial burn testing completed on COB-2, Shell would expect permit limits to be established as delineated in **Table 3-4**, pending the outcome of the Condition 3 retest.

Table 3-1 Process Operating Data Summary – Test Condition 1

Operating Parameters (a)	Units	C1-R1 Min.	C1-R1 Max.	C1-R1 Avg.	C1-R2 Min.	C1-R2 Max.	C1-R2 Avg.
Date		06-Jun-06			06-Jun-06		
Start		09:30			12:45		
Stop		11:40			14:57		
Process Parameters --							
Waste Feed Rate (HRA)	gpm	6.99	7.01	7.00	5.99	7.01	6.54
Waste Feed Atom. Press. (INST)	psig	78.0	80.6	79.4	77.5	80.8	79.3
Firebox Temperature (HRA)	°F	1,711	1,718	1,715	1,713	1,719	1,716
Firebox Pressure (HRA)	in. w.c.	1.22	1.25	1.23	1.20	1.26	1.22
ESP Power (INST)	kVa	32.9	33.9	33.3	30.3	31.9	30.8
Stack Gas Flowrate (INST)	in. w.c.	0.489	0.920	0.701	0.468	0.857	0.706
Stack Gas Flowrate (calculated)	scfm	68,889	70,644	69,756	68,352	70,422	69,356
CEM Parameters --							
CO Conc. @ 7% O_2 (HRA)	ppm	16.1	18.5	16.9	14.0	17.1	15.2
O_2 Concentration (OMA)	%	3.14	3.63	3.31	3.18	3.56	3.38

Operating Parameters (a)	Units	C1-R3 Min.	C1-R3 Max.	C1-R3 Avg.	RCRA Trial Burn June 6, 2006 Condition 1 Averages MIN	MAX	AVG
Date		06-Jun-06					
Start		15:30					
Stop		17:40					
Process Parameters --							
Waste Feed Rate (HRA)	gpm	6.99	7.00	7.00	**6.66**	**7.01**	**6.85**
Waste Feed Atom. Press. (INST)	psig	77.9	80.7	79.3	**77.8**	**80.7**	**79.3**
Firebox Temperature (HRA)	°F	1,711	1,716	1,714	**1,712**	**1,718**	**1,715**
Firebox Pressure (HRA)	in. w.c.	1.20	1.25	1.23	**1.21**	**1.25**	**1.23**
ESP Power (INST)	kVa	30.4	30.8	30.6	**31.2**	**32.2**	**31.6**
Stack Gas Flowrate (INST)	in. w.c.	0.430	0.872	0.708	**0.462**	**0.883**	**0.705**
Stack Gas Flowrate (calculated)	scfm	67,016	69,485	68,352	**68,086**	**70,184**	**69,155**
CEM Parameters --							
CO Conc. @ 7% O_2 (HRA)	ppm	11.7	15.8	12.9	**13.9**	**17.1**	**15.0**
O_2 Concentration (OMA)	%	3.42	3.77	3.58	**3.25**	**3.65**	**3.42**

(a) HRA = Hourly Rolling Average INST = Instantaneous OMA = one-minute average

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Table 3-2 Process Operating Data Summary – Test Condition 2

Operating Parameters (a)	Units	C2-R1 Min.	C2-R1 Max.	C2-R1 Avg.	C2-R2 Min.	C2-R2 Max.	C2-R2 Avg.
Date		07-Jun-06			08-Jun-06		
Start			10:00	16:22		08:00	13:15
Stop			13:40	19:35		11:10	15:50
Process Parameters --							
Waste Feed Rate (HRA)	gpm	8.35	9.09	8.63	8.92	9.06	8.99
Waste Feed Atom. Press. (INST)	psig	78.0	81.1	79.3	77.8	81.1	79.3
Firebox Temperature (HRA)	°F	1,712	1,718	1,715	1,712	1,720	1,716
Firebox Pressure (HRA)	in. w.c.	1.17	1.29	1.23	1.30	1.49	1.41
ESP Power (INST)	kVa	121.7	181.6	164.0	90.2	143.7	114.5
Stack Gas Flowrate (INST)	in. w.c.	0.472	0.958	0.746	0.322	0.901	0.652
Stack Gas Flowrate (calculated)	scfm	67,688	70,487	68,970	56,389	71,272	68,784
CEM Parameters --							
CO Conc. @ 7% O_2 (HRA)	ppm	9.97	16.3	13.6	11.7	14.4	12.6
O_2 Concentration (OMA)	%	3.30	4.06	3.71	3.48	3.96	3.72

Operating Parameters (a)	Units	C2-R3 Min.	C2-R3 Max.	C2-R3 Avg.	RCRA Trial Burn June 7 - 9, 2006 Condition 2 Averages MIN	MAX	AVG
Date		09-Jun-06					
Start			08:00	13:10			
Stop			11:54	15:35			
Process Parameters --							
Waste Feed Rate (HRA)	gpm	8.69	9.00	8.85	**8.65**	**9.05**	**8.82**
Waste Feed Atom. Press. (INST)	psig	77.0	80.9	79.0	**77.6**	**81.0**	**79.2**
Firebox Temperature (HRA)	°F	1,711	1,729	1,718	**1,712**	**1,722**	**1,716**
Firebox Pressure (HRA)	in. w.c.	1.29	1.48	1.41	**1.25**	**1.42**	**1.35**
ESP Power (INST)	kVa	95.5	185.8	132.4	**102.5**	**170.4**	**137.0**
Stack Gas Flowrate (INST)	in. w.c.	0.193	1.043	0.685	**0.329**	**0.967**	**0.694**
Stack Gas Flowrate (calculated)	scfm	54,208	72,973	68,799	**59,428**	**71,577**	**68,851**
CEM Parameters --							
CO Conc. @ 7% O_2 (HRA)	ppm	11.0	17.7	14.0	**10.9**	**16.1**	**13.4**
O_2 Concentration (OMA)	%	3.42	4.02	3.68	**3.40**	**4.01**	**3.70**

(a) HRA = Hourly Rolling Average INST = Instantaneous OMA = one-minute average

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Table 3-3 Process Operating Data Summary – Test Condition 3

Operating Parameters (a)	Units	C3-R1 Min.	C3-R1 Max.	C3-R1 Avg.	C3-R2 Min.	C3-R2 Max.	C3-R2 Avg.
	Date	13-Jun-06			13-Jun-06		
	Start	10:30			12:55		
	Stop	12:35			14:59		
Process Parameters --							
Waste Feed Rate (HRA)	gpm	8.88	9.68	9.28	8.98	10.6	9.74
Waste Feed Atom. Press. (INST)	psig	77.1	81.4	79.0	42.3	81.3	59.8
Firebox Temperature (HRA)	°F	1,604	1,614	1,608	1,609	1,625	1,618
Firebox Pressure (HRA)	in. w.c.	5.83	5.95	5.87	5.88	6.08	5.99
ESP Power (INST)	kVa	78.0	148.3	100.6	77.1	116.4	103.8
Stack Gas Flowrate (INST)	in. w.c.	1.151	1.984	1.551	1.143	1.940	1.566
Stack Gas Flowrate (calculated)	scfm	87,490	92,338	90,744	88,370	93,191	91,025
CEM Parameters --							
CO Conc. @ 7% O_2 (HRA)	ppm	7.67	13.9	11.1	7.38	16.0	12.8
O_2 Concentration (OMA)	%	5.19	5.82	5.53	5.18	5.96	5.56

Operating Parameters (a)	Units	C3-R3 Min.	C3-R3 Max.	C3-R3 Avg.	RCRA Trial Burn June 13, 2006 Condition 3 Averages MIN	MAX	AVG
	Date	13-Jun-06					
	Start	15:16					
	Stop	17:15					
Process Parameters --							
Waste Feed Rate (HRA)	gpm	10.7	11.0	10.9	**9.52**	**10.41**	**9.97**
Waste Feed Atom. Press. (INST)	psig	42.0	45.1	42.7	**53.8**	**69.3**	**60.5**
Firebox Temperature (HRA)	°F	1,612	1,623	1,616	**1,608**	**1,621**	**1,614**
Firebox Pressure (HRA)	in. w.c.	5.83	5.97	5.92	**5.85**	**6.00**	**5.93**
ESP Power (INST)	kVa	88.1	121.4	106.4	**81.1**	**128.7**	**103.6**
Stack Gas Flowrate (INST)	in. w.c.	1.148	2.113	1.601	**1.147**	**2.012**	**1.573**
Stack Gas Flowrate (calculated)	scfm	89,214	93,297	91,347	**88,358**	**92,942**	**91,039**
CEM Parameters --							
CO Conc. @ 7% O_2 (HRA)	ppm	6.89	8.37	7.45	**7.31**	**12.8**	**10.5**
O_2 Concentration (OMA)	%	5.26	5.61	5.45	**5.21**	**5.80**	**5.51**

(a) HRA = Hourly Rolling Average INST = Instantaneous OMA = one-minute average

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Table 3-4 Anticipated Permit Conditions

Process Parameter	Units	Meas. Basis **(a)**	Value From? **(b)**	Expected Limit
Maximum Waste Feed Rate to each CO Boiler (DNF Solids + Biosolids)	gpm	HRA	C3	10.55
Maximum Total DNF Solids (RCRA Waste) to all 3 CO Boilers	ton/yr	HRA	Current Limit	28,000
Maximum Total Waste Feed Rate to all 3 CO Boilers (DNF Solids + Biosolids)	gpm	HRA	C3	31.65
Minimum Waste Feed Atomization Pressure **(c)**	psig	INST	C3	53.8
Minimum Firebox Temperature	°F	HRA	C3	1,608
Maximum Firebox Pressure	in. w.c.	HRA	C3	6.0
Minimum ESP Power	kVa	INST	C1	31.2
Maximum Stack Gas Flowrate	scfm	INST	Prior Trial Burn	154,400
CO Conc. @ 7% O_2	ppm	HRA	Regulation	100

(a) HRA = Hourly Rolling Average INST = Instantaneous OMA = one-minute average

(b) C1 = Test Condition 1; C3 = Test Condition 3

(c) Defined as the differential fluid pressure between atomizing fluid and waste feed.

Note 1: The waste feed rate includes the contribution from the MCB added (0.14 gpm)

Note 2: Limits based on Condition 3 will be re-established pending a successful retest.

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4.0 Sampling and Analytical Program Overview

This section provides a brief overview of the methods and procedures followed for the field test program. A complete and more detailed summary of the sampling and analytical methodologies employed can be found in Sections 5.4 and 5.6 of the approved Trial Burn Plan.

The trial burn was conducted in June 2006 and was implemented by a diverse team of experienced project managers and technical specialists from Shell Martinez, ENSR and several Shell / ENSR subcontractors. Key project participants and associated responsibilities were as follows:

- Steven Overman – Overall Shell trial burn coordinator
- Fred Ferrante – Shell coordinator for control room operations and waste feed sampling
- Oahn Ma – Shell coordinator for process data generation
- Mike Dudasko – ENSR program manger
- Doug Roeck – ENSR field test coordinator and task manager for trial burn plan development and final data reporting
- Shawn Nelezen – Field sampling test team leader for the Avogadro Group, LLC
- Marty Friedman – POHC spiking team leader for Triad Chemicals, LLC (Condition 3).

4.1 Waste Feed Stream

Throughout the test program, samples of the liquid waste feed stream were collected periodically and composited over the course of each run. Samples were collected in 40-mL, 500-mL and 950-mL sample bottles and a field data sheet was completed denoting the times that these samples were taken. The waste feed samples collected were submitted to STL-Knoxville for physical parameters (ash, total chlorides, density, moisture and heat content) and STL-Sacramento for metals and organics analyses. Analytical methods followed included ASTM D 482-00a (ash), EPA Method 9056 (KNOX WC-0016) (total chlorides), ASTM D 1963-85 (density), ASTM D 240-02 (heat content), ASTM D 1744 (Karl Fischer) (moisture), EPA Method 6020 (all metals except mercury) and EPA Method 7470A (mercury). Additional samples were submitted to STL-Sacramento for volatile and semivolatile organics analysis. EPA Methods 8260B and 8270C were employed for these organic analyses.

4.2 Spiking Material

The MCB material provided by Triad was not sampled during the program as it was a pure grade product. The supplier of the MCB provided a certificate of analysis as to the product purity which was 99.9986%. The feed rates reported by Triad accounted for this product purity. The target feed rate for the MCB (during Condition 3) was 75.0 lb/hr and this level was achieved with excellent accuracy throughout the test. The full report submitted by Triad can be found in Appendix C.

4.3 Stack Gas

The following sections provide brief overviews of the sampling methodologies employed for all target parameters. Except where noted otherwise, all methods are from SW-846, 3rd edition, final (promulgated) Update III. All samples were collected from the single stack sampling platform available on COB-2.

4.3.1 Carbon Dioxide, Carbon Monoxide, Oxygen and Total Hydrocarbons

During all sampling runs, Avogadro continuously collected samples of stack gas for oxygen (O_2), carbon dioxide (CO_2) and total hydrocarbons (THC) determination. The O_2 and CO_2 data were used in the calculation of stack gas molecular weight. EPA Reference Method 3A (40 CFR Part 60, Appendix A) was used for the analytical procedure (continuous emission monitor). EPA Reference Method 25A was used for the THC determination. In addition, Shell continuously measured data for CO corrected to 7% oxygen during all runs with the facility's permanently installed CEMS.

4.3.2 Particulate Matter

Sampling for PM only was performed in accordance with EPA Reference Method 5. The method was followed as written without modification and was performed during Condition 1 only. Run times were 120 minutes in duration and involved isokinetic sampling at 24 sampling points (12 points per traverse). PM samples (including one field blank) were submitted to Avogadro's analytical laboratory in Martinez, CA for gravimetric analysis.

4.3.3 Particulate Matter, Hydrogen Chloride, Chlorine and Ammonia

Sampling for PM, HCl, Cl_2 and NH_3 was performed in accordance with EPA Method 0050. The method was followed as written without modification and was performed during Condition 2 only. Run times were 120 minutes in duration and involved isokinetic sampling at 24 sampling points (12 points per traverse). PM samples (including one field blank) were submitted to Avogadro's analytical laboratory in Martinez, CA for gravimetric analysis. Impinger solution samples (including one field blank) for HCl, Cl_2 and NH_3 determination were submitted to STL-Sacramento for analysis by ion chromatography (EPA Methods 9057 and 350.1).

4.3.4 Carbonyl Compounds

A Method 0011 sampling train was used to sample for target carbonyl compounds (acetaldehyde, crotonaldehyde, formaldehyde and propionaldehyde) during Condition 2 only. Run times were 120 minutes in duration and involved isokinetic sampling at 24 sampling points (12 points per traverse). This method uses 2,4-Dinitrophenylhydrazine (DNPH) reagent as the absorbent medium in the sampling train. The DNPH reagent was prepared by the laboratory within 5 days of use in the field and when a container of the DNPH was opened in the field, it was used within 48 hrs. The reagent was prepared by Enthalpy Analytical, Inc. of Durham, NC who also performed sample analyses. Each sampling train was prepared and analyzed according to EPA Method 8315A. This method entails high performance liquid chromatography (HPLC) with ultraviolet/visible detection. Procedure 1 of Method 8315A is followed for stack gas samples collected by this method.

4.3.5 Metals

EPA Method 29 was followed as written without modification and was performed during Condition 2 only. This sampling train was utilized for the collection of all target metals including aluminum, antimony, arsenic, barium, beryllium, cadmium, total chromium, cobalt, copper, lead, manganese, mercury, nickel, selenium, silver, thallium, vanadium and zinc. Run times were 120 minutes in duration and involved isokinetic sampling at 24 sampling points (12 points per traverse). Program samples (including one reagent blank) were submitted to STL-Sacramento for analysis by Inductively Coupled Argon Plasma Mass Spectroscopy (ICP-MS) as described in EPA Method 6020 (all metals except mercury). Mercury analysis was performed by cold vapor atomic absorption spectrometry (CVAAS) following EPA Method 7470A.

4.3.6 Hexavalent Chromium

EPA Method 0061 was followed as written without modification and was performed during Condition 2 only. This sampling train was utilized for the determination of hexavalent chromium. Run times were 120 minutes in duration and involved isokinetic sampling at 24 sampling points (12 points per traverse). Program samples (including one field blank) were submitted to STL-Knoxville for analysis by EPA Method 7199, which involves ion chromatography coupled with a post-column reactor (IC/PCR).

4.3.7 PCDDs/PCDFs and PAHs

A combined Method 0023A/0010 sampling train was used to sample for PCDDs/PCDFs and PAHs during Condition 2 only. PCDDs/PCDFs were collected following the procedures outlined in EPA Method 0023A. Target PAHs were collected following the procedures outlined in EPA Method 0010. Run times were 180 minutes in duration and involved isokinetic sampling at 24 sampling points (12 points per traverse). The sampling methodology for collection of PAHs also incorporates the collection of the XAD trap condensate for subsequent analysis. Sample train rinse solvents used were those specified in Method 0023A (acetone, methylene chloride and toluene). Program samples (including one field blank) were submitted to Alta Analytical Laboratories in El Dorado Hills, CA for analysis of all target parameters. Analysis for PCDD/PCDF congeners followed EPA Method 8290 which incorporates high resolution gas chromatography and high resolution mass spectrometry (HRGC/HRMS). Analysis for carcinogenic and non-carcinogenic PAHs followed CARB Method 429, which also incorporates HRGC/HRMS techniques.

4.3.8 Target Semivolatile Organics

An EPA Method 0010 sampling train was used to sample for 49 target SVOCs during Condition 2 only. The method was followed as written without modification. Additional SVOC emission data were obtained through an assessment of TICs using mass spectral library searching and identification of up to 15 additional compounds. Run times were 180 minutes in duration and involved isokinetic sampling at 24 sampling points (12 points per traverse). Sample train fractions were submitted to STL-Sacramento for analysis by EPA Method 8270C. This procedure also featured the reporting of data for individual sample train fractions as per the extraction procedure outlined by EPA Method 3542.

4.3.9 Target Volatile Organics and POHC DRE

EPA Method 0030 was followed as written without modification during Condition 2 only to determine stack gas concentrations of 64 target volatile organics. Additional VOC emission data were obtained through an assessment of tentatively identified compounds (TICs) using mass spectral library searching and identification of up to 15 additional compounds. During Condition 3, the VOST methodology was used to determine emission levels of MCB only for assessment of POHC DRE. During each run, four (4) pairs of VOST tubes were collected, each at a sampling rate of 1.0 liter per minute (Lpm) over a 20-minute period, resulting in a sample volume of approximately 20 liters per pair. Three of the four pairs from each run (a, b and d) were designated for analysis. The first set of VOST tubes from each run (pair “a”) was intended to be analyzed individually to provide an assessment of compound breakthrough. A single condensate sample representative of each four run set was also collected. Samples were submitted to STL-Knoxville for analysis by EPA Methods 5041A (VOST tubes) and 8260B (condensate). VOST blanks collected included field blanks, trip blanks and condensate blanks.

5.0 Trial Burn Test Results

This section presents all sampling and analytical results for the trial burn associated with COB-2. All data presented are judged to be completely acceptable based on a thorough data review and comparison with documented QA protocols. All pertinent QA/QC data and related discussions are presented subsequently in Section 6.0. The field sampling report prepared by The Avogadro Group, LLC is provided in Appendix B. Additional field data sheets and other related field documentation coordinated by ENSR are found in Appendix D. Analytical data reports provided by each of the subcontractor laboratories for all field sample analyses are located in Appendix E.

5.1 Waste Feed Stream

The waste feed material fed to the combustor during each test condition was analyzed for physical parameters, volatile and semivolatile organics and metals. Analysis for all parameters was performed during all test runs. Results are presented in **Tables 5-1 through 5-4**. The waste material is shown to have a very high water content (> 95%); low or non-detectable levels of ash and chlorine; and low or non-detectable levels of most metals. The waste was analyzed for 49 target SVOCs and 64 target VOCs. No SVOCs and only 5 VOCs were present at a level higher than the compound-specific reporting limit (RL). Data pertaining to these organic analyses can be found in Appendix E.

5.2 Spiking Material

The spiking of MCB during Condition 3 was accomplished without incident and at rates at or near the target level of 75.0 lb/hr. The full report prepared by Triad Chemicals, LLC is presented in Appendix C.

5.3 Stack Gas Measurements – Condition 1

5.3.1 Oxygen, Carbon Dioxide and Total Hydrocarbons

Continuous measurement of fixed gases (O_2 and CO_2) and THC was performed throughout test condition 1. Results are summarized below:

Run No.	O_2	CO_2	THC
C1-R1	3.42	13.98	0.37
C1-R2	3.32	14.10	0.67
C1-R3	3.53	13.80	0.00

5.3.2 Particulate Matter

The main goal of test condition 1 was to determine the magnitude of stack gas particulate emissions while the ESP was operated at low power input (~ 30 kVa). Emission results for PM are provided in **Table 5-5**. The data show that COB-2 fully complied with the performance standard of 0.08 gr/dscf corrected to 7% oxygen. Test results averaged 0.0114 gr/dscf corrected to 7% oxygen for the three runs performed.

5.4 Stack Gas Measurements – Condition 2

5.4.1 Oxygen, Carbon Dioxide and Total Hydrocarbons

Continuous measurement of fixed gases (O_2 and CO_2) and THC was performed throughout test condition 2. Results are summarized below:

Run No.	O_2	CO_2	THC
C2-R1 (AM)	4.32	13.23	0.06
C2-R1 (PM)	3.79	13.66	0.00
C2-R2 (AM)	3.74	13.64	0.35
C2-R2 (PM)	3.72	13.73	0.00
C2-R3 (AM)	2.59	11.09	0.37
C2-R3 (PM)	3.59	13.45	0.06

5.4.2 Particulate Matter

Gravimetric analyses for particulate matter on the front-half rinse and filter fractions from the Method 0050 sampling train was performed by Avogadro with results blank-corrected for acetone contamination to the maximum extent allowed by EPA Method 5. Results are presented in **Table 5-6**. Test results averaged 0.0046 and were well below the current permit limit (0.08 gr/dscf corrected to 7% oxygen) as well as the future MACT limit (0.035 gr/dscf corrected to 7% oxygen).

5.4.3 Hydrogen Chloride, Chlorine and Ammonia

Appropriate back-half fractions from the Method 0050 sampling train were analyzed for HCl, Cl_2 and NH_3 at STL-Sacramento. These results are also found in **Table 5-6**. Emission concentrations for HCl and Cl_2 easily comply with current permit limits as well as the future MACT standard for liquid fuel-fired boilers (31 ppm).

5.4.4 Carbonyl Compounds

The emission rate of four target aldehyde compounds was evaluated using EPA Method 0011. A summary of key sampling parameters and calculated emission rates is shown in **Table 5-7**. Except for acetaldehyde during C2-R1 and C2-R2, no compounds were observed above the method-specific RL.

5.4.5 Metals

Results for all target metals from the EPA Method 29 sampling train were reported by STL-Sacramento. In addition, ENSR performed blank-correction on all the data for field blank reagent contamination to the maximum extent allowed by the method. Results are given in **Table 5-8**. These results demonstrate full compliance with current permit limits. In addition, emission concentrations for low volatile metals (arsenic, beryllium and chromium), semivolatile metals (cadmium and lead) and mercury easily comply with the future MACT standards for liquid fuel-fired boilers (370, 150 and 19 µg/dscm, respectively).

5.4.6 Hexavalent Chromium

Analyses for hexavalent chromium from the EPA Method 0061 sampling train were reported by STL-Knoxville. Results are provided in **Table 5-9**. No emission standard currently applies to this parameter.

5.4.7 PCDDs/PCDFs and PAHs

Samples from the Method 0023A sampling train were analyzed by Alta Analytical for all target analytes and reported as combined front-half and back-half results. PCDD/PCDF analyses followed the protocols outlined in EPA Methods 0023A and 8290, which incorporate HRGC/HRMS techniques. PAH analyses followed the procedures outlined in CARB Method 429, which also employs HRGC/HRMS. Results for PCDDs/PCDFs are shown in **Table 5-10** and results for PAHs are provided in **Table 5-11**.

5.4.8 Target Semivolatile Organics

SVOCs were reported by STL-Sacramento from the EPA Method 0010 sampling train. Emission results are presented in **Table 5-12**. Most SVOCs were reported as "non-detect" and thus emission rates have been calculated at the reported detection limit. TIC results (which vary from run to run) are included with the analytical data reports located in Appendix E. Bearing in mind that certain compounds can be detected even though the value is below the typical RL, the following table summarizes the number of "hits" out of the total of 49 specific target compounds:

Run No.	Total Compounds Detected	Total Compounds Detected Above the RL
C2-R1	1	0
C2-R2	1	0
C2-R3	3	1

5.4.9 Target Volatile Organics

The emission rates for target volatile organics were evaluated via Method 0030, the volatile organic sampling train (VOST). A summary of sampling parameters for all VOST runs is shown in **Table 5-13**. VOST runs were completed during the same overall period as the Method 0010 and 0023A isokinetic sampling trains and therefore stack flow rates used in conjunction with the VOST emission calculations represent the average flow rates determined with these sampling trains. Emission results are shown in **Table 5-14**. Most compounds were reported as "non-detect" and thus emission rates have been calculated at the reported detection limit. TIC results (which vary from run to run) are included with the analytical data reports located in Appendix E.

Bearing in mind that certain compounds can be detected even though the value is below the typical RL, the following table summarizes the number of "hits" out of the total of 64 specific target compounds:

Run No.	Total Compounds Detected	Total Compounds Detected Above the RL
C2-R1	10	3
C2-R2	11	4
C2-R3	6	2

5.5 Stack Gas Measurements – Condition 3

5.5.1 Oxygen, Carbon Dioxide and Total Hydrocarbons

Continuous measurement of fixed gases (O_2 and CO_2) and THC was performed throughout test condition 3. Results are summarized below:

Run No.	O_2	CO_2	THC
C3-R1	5.52	11.99	0.21
C3-R2	5.37	11.98	0.04
C3-R3	5.24	12.13	0.05

5.5.2 POHC DRE

The VOST methodology was also used during Condition 3 to determine the emission rate for MCB to allow calculation of the DRE for this compound. A summary of sampling parameters for all VOST runs is shown in **Table 5-15**. EPA Method 2 and Method 4 runs were also conducted concurrently with the VOST runs to allow determination of stack gas flowrate. Emission results and DRE calculations are shown in **Table 5-16**.

Unfortunately, C3-R1 was the only run that achieved an acceptable DRE. Retesting will be performed at a future time and an addendum to this report will be provided.

Table 5-1 Waste Stream Analytical Results for Physical Parameters

Analytical Parameters	Units	Test Condition 1			
		C1-R1	C1-R2	C1-R3	Avg.
Total Chlorides	mg/kg	285	372	300	**319**
Ash Content	mg/kg	6,110	6,010	5,920	**6,013**
Heat Content	Btu/lb	380	455	384	**406**
Water Content	%	96.17	96.54	97.21	**96.64**
Density	g/cc	0.939	0.917	0.942	**0.933**
Analytical Parameters	**Units**	**Test Condition 2**			
		C2-R1	**C2-R2**	**C2-R3**	**Avg.**
Total Chlorides	mg/kg	297	327	299	**308**
Ash Content	mg/kg	6,210	7,170	7,010	**6,797**
Heat Content	Btu/lb	351	412	431	**398**
Water Content	%	96.69	96.20	96.71	**96.53**
Density	g/cc	0.923	0.943	0.930	**0.932**
Analytical Parameters	**Units**	**Test Condition 3**			
		C3-R1	**C3-R2**	**C3-R3**	**Avg.**
Total Chlorides	mg/kg	112	108	106	**109**
Ash Content	mg/kg	1,420	1,410	1,520	**1,450**
Heat Content	Btu/lb	< 1,800	202	< 1,800	**< 1,267**
Water Content	%	99.35	99.72	99.68	**99.58**
Density	g/cc	0.992	0.993	0.994	**0.993**

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Table 5-2 Waste Stream Analytical Results for Target Metals (Condition 1)

Analytical Parameters	Units				
		C1-R1	C1-R2	C1-R3	Avg.
Silver	µg / L	0.59	0.45	0.62	**0.55**
Aluminum	µg / L	120	91	103	**105**
Arsenic	µg / L	0.24	0.20	0.22	**0.22**
Barium	µg / L	6.0	4.8	5.5	**5.4**
Beryllium	µg / L	0.0032	0.0025	0.0030	**0.0029**
Cadmium	µg / L	0.0067	0.0054	0.0059	**0.0060**
Cobalt	µg / L	0.33	0.26	0.29	**0.29**
Chromium	µg / L	1.2	0.89	1.1	**1.1**
Copper	µg / L	0.81	0.64	0.73	**0.73**
Manganese	µg / L	4.4	3.4	4.0	**3.9**
Nickel	µg / L	3.9	3.0	3.5	**3.5**
Lead	µg / L	0.26	0.20	0.23	**0.23**
Antimony	µg / L	0.0028	0.0030	0.0031	**0.0030**
Selenium	µg / L	5.4	4.1	4.9	**4.8**
Thallium	µg / L	< 0.010	< 0.010	< 0.010	**< 0.010**
Vanadium	µg / L	9.6	7.3	8.1	**8.3**
Zinc	µg / L	18.8	14.6	16.3	**16.6**
Mercury	µg / L	0.13	0.19	0.34	**0.22**

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Table 5-3 Waste Stream Analytical Results for Target Metals (Condition 2)

Analytical Parameters	Units				
		C2-R1	C2-R2	C2-R3	Avg.
Silver	µg / L	0.53	0.35	0.39	**0.42**
Aluminum	µg / L	110	154	157	**140**
Arsenic	µg / L	0.22	0.25	0.26	**0.24**
Barium	µg / L	5.1	6.0	5.6	**5.6**
Beryllium	µg / L	0.0027	0.0036	0.0031	**0.0031**
Cadmium	µg / L	0.0060	0.0080	0.0080	**0.0073**
Cobalt	µg / L	0.31	0.42	0.44	**0.39**
Chromium	µg / L	0.98	1.10	1.10	**1.06**
Copper	µg / L	0.76	1.0	1.0	**0.92**
Manganese	µg / L	4.1	5.5	5.5	**5.0**
Nickel	µg / L	3.6	5.0	5.0	**4.5**
Lead	µg / L	0.24	0.30	0.31	**0.28**
Antimony	µg / L	0.0024	0.0025	0.0021	**0.0023**
Selenium	µg / L	4.6	5.5	5.5	**5.2**
Thallium	µg / L	< 0.010	< 0.010	< 0.010	**< 0.010**
Vanadium	µg / L	8.7	12.4	13.0	**11.4**
Zinc	µg / L	17.6	24.1	24.8	**22.2**
Mercury	µg / L	0.27	0.28	0.31	**0.29**

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Table 5-4 Waste Stream Analytical Results for Target Metals (Condition 3)

Analytical Parameters	Units	C3-R1	C3-R2	C3-R3	Avg.
Silver	µg / L	0.50	0.40	0.48	**0.46**
Aluminum	µg / L	38.7	36.4	38.1	**37.7**
Arsenic	µg / L	0.058	0.052	0.058	**0.056**
Barium	µg / L	1.5	1.3	1.5	**1.4**
Beryllium	µg / L	0.00089	< 0.010	< 0.010	**< 0.007**
Cadmium	µg / L	0.0020	0.0019	0.0021	**0.0020**
Cobalt	µg / L	0.11	0.096	0.10	**0.10**
Chromium	µg / L	0.27	0.26	0.27	**0.27**
Copper	µg / L	0.25	0.23	0.25	**0.24**
Manganese	µg / L	1.4	1.3	1.4	**1.4**
Nickel	µg / L	1.2	1.1	1.2	**1.2**
Lead	µg / L	0.075	0.068	0.074	**0.072**
Antimony	µg / L	0.0010	0.00096	0.0010	**0.0010**
Selenium	µg / L	1.2	1.2	1.3	**1.2**
Thallium	µg / L	< 0.010	< 0.010	< 0.010	**< 0.010**
Vanadium	µg / L	3.1	2.8	3.0	**3.0**
Zinc	µg / L	5.8	5.4	5.7	**5.6**
Mercury	µg / L	0.0050	0.0390	0.0390	**0.0277**

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Table 5-5 Sampling Parameters and Emission Results for PM (Condition 1)

Run No.		C1-R1	C1-R2	C1-R3	
Date		06-Jun-06	06-Jun-06	06-Jun-06	
Start Time	Units	09:30	12:45	15:30	
Stop Time		11:40	14:57	17:40	**AVGS**
Sampling Parameters --					
Barometric Pressure	in. Hg	29.68	29.68	29.68	29.68
Volume Metered	dcf	80.336	83.535	83.853	82.575
Volume of Gas Collected	dscf	75.760	77.601	77.209	76.857
Moisture	% v/v	18.4	17.2	18.5	18.0
O_2 at Stack	% dry	3.42	3.32	3.53	3.42
CO_2 at Stack	% dry	13.98	14.10	13.80	13.96
Avg. Stack Temp.	°F	571	576	579	575
Stack Flowrate	dscfm	101,938	102,168	100,603	101,570
Isokinetics	%	96	98	99	98
Particulate Emission Results --					
Front Half Rinse	mg	34.74	20.25	19.09	24.69
Particulate Filter	mg	57.30	49.38	33.77	46.82
Total Particulate	mg	92.04	69.63	52.86	71.51
PM Loading @ 7% O_2	mg/dscm	34.2	25.1	19.4	26.2
Grain Loading	gr/dscf	0.0187	0.0138	0.0105	0.0144
Grain Loading @ 7% O_2	gr/dscf	0.0149	0.0109	0.0084	0.0114
Emission Rate	lb/hr	16.3	12.1	9.1	12.5

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Table 5-6 Sampling Parameters and Emission Results for PM, HCl, Cl_2 and NH_3 (Condition 2)

Run No.		C2-R1	C2-R2	C2-R3	
Date		07-Jun-06	08-Jun-06	09-Jun-06	
Start Time	Units	10:00	13:20	13:10	
Stop Time		13:25	15:50	15:35	**AVGS**
Sampling Parameters --					
Barometric Pressure	in. Hg	29.68	29.73	29.62	29.68
Volume Metered	dcf	83.224	85.324	89.699	86.082
Volume of Gas Collected	dscf	77.289	79.170	84.284	80.248
Moisture	% v/v	19.6	19.3	19.5	19.4
O_2 at Stack	% dry	4.32	3.72	3.59	3.88
CO_2 at Stack	% dry	13.23	13.73	13.45	13.47
Avg. Stack Temp.	°F	569	574	578	573
Stack Flowrate	dscfm	100,055	100,735	107,041	102,610
Isokinetics	%	100	101	102	101
PM Emission Results --					
Front Half Rinse	mg	24.84	7.96	17.13	16.64
Particulate Filter	mg	16.32	3.40	17.67	12.46
Total Particulate	mg	41.16	11.36	34.80	29.11
PM Loading @ 7% O_2	mg/dscm	15.8	4.1	11.7	10.5
Grain Loading	gr/dscf	0.0082	0.0022	0.0064	0.0056
Grain Loading @ 7% O_2	gr/dscf	0.0069	0.0018	0.0051	0.0046
Emission Rate	lb/hr	7.03	1.91	5.83	4.93
HCl Emission Results --					
Total HCl Detected	µg	3,700	4,300	1,200	3,067
Total HCl Concentration	ppm	1.11	1.26	0.33	0.90
Conc. @ 7% O_2	ppm	0.93	1.02	0.27	0.74
HCl Emission Rate	g/sec	0.080	0.091	0.025	0.065
Cl_2 Emission Results --					
Total Cl_2 Detected	µg	< 640	< 500	< 1,000	< 713
Total Cl_2 Concentration	ppm	< 0.10	< 0.08	< 0.14	< 0.11
Conc. @ 7% O_2	ppm	< 0.08	< 0.06	< 0.12	< 0.09
Cl_2 Emission Rate	g/sec	< 0.014	< 0.011	< 0.021	< 0.015
NH_3 Emission Results --					
Quantity Detected (as N)	µg	88,000	88,300	84,800	87,033
Total NH_3 Detected	µg	106,857	107,221	102,971	105,683
Total NH_3 Concentration	ppm	68.9	67.5	60.9	65.8
Conc. @ 7% O_2	ppm	57.9	54.7	49.0	53.9
NH_3 Emission Rate	lb/hr	15.1	14.9	14.2	14.7

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Table 5-7 Sampling Parameters and Emission Results for Carbonyl Compounds (Condition 2)

Run No.		C2-R1	C2-R2	C2-R3	
Date		07-Jun-06	08-Jun-06	09-Jun-06	
Start Time	Units	10:00	13:20	13:10	
Stop Time		13:25	15:50	15:35	**AVGS**
Sampling Parameters --					
Barometric Pressure	in. Hg	29.68	29.62	29.76	29.69
Volume Metered	dcf	77.110	78.675	76.580	77.455
Sample Volume	dscf	74.374	75.051	73.337	74.254
Moisture	% v/v	18.8	20.4	18.8	19.3
O_2 at Stack	% dry	4.32	3.72	3.59	3.88
Avg. Stack Temp.	°F	572	575	580	576
Stack Flowrate	dscfm	95,369	92,186	94,292	93,949
Isokinetics	%	101	105	100	102
Acetaldehyde --					
Quantity Collected	µg	4.59	9.84	< 5.20	< 6.54
Stack Conc. @ 7% O_2	µg/m³	1.83	3.75	< 2.01	< 2.53
Stack Emission Rate	lb/hr	7.8E-04	1.6E-03	< 8.8E-04	< 1.1E-03
	g/sec	9.8E-05	2.0E-04	< 1.1E-04	< 1.4E-04
Crotonaldehyde --					
Quantity Collected	µg	< 3.45	< 9.80	< 5.20	< 6.15
Stack Conc. @ 7% O_2	µg/m³	< 1.38	< 3.74	< 2.01	< 2.38
Stack Emission Rate	lb/hr	< 5.9E-04	< 1.6E-03	< 8.8E-04	< 1.0E-03
	g/sec	< 7.4E-05	< 2.0E-04	< 1.1E-04	< 1.3E-04
Formaldehyde --					
Quantity Collected	µg	< 3.45	< 9.80	< 5.20	< 6.15
Stack Conc. @ 7% O_2	µg/m³	< 1.38	< 3.74	< 2.01	< 2.38
Stack Emission Rate	lb/hr	< 5.9E-04	< 1.6E-03	< 8.8E-04	< 1.0E-03
	g/sec	< 7.4E-05	< 2.0E-04	< 1.1E-04	< 1.3E-04
Propionaldehyde --					
Quantity Collected	µg	< 3.45	< 9.80	< 5.20	< 6.15
Stack Conc. @ 7% O_2	µg/m³	< 1.38	< 3.74	< 2.01	< 2.38
Stack Emission Rate	lb/hr	< 5.9E-04	< 1.6E-03	< 8.8E-04	< 1.0E-03
	g/sec	< 7.4E-05	< 2.0E-04	< 1.1E-04	< 1.3E-04

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Table 5-8 Sampling Parameters and Emission Results for Target Metals (Condition 2)

Run No.		C2-R1	C2-R2	C2-R3	
Date		07-Jun-06	08-Jun-06	09-Jun-06	
Start Time	Units	10:00	13:20	13:10	
Stop Time		13:25	15:50	15:35	**AVGS**
Sampling Parameters --					
Barometric Pressure	in. Hg	29.68	29.80	29.62	29.70
Volume Metered	dcf	87.815	82.943	80.562	83.773
Sample Volume	dscf	81.739	77.889	75.596	78.408
Moisture	% v/v	17.0	16.0	18.7	17.2
O_2 at Stack	% dry	4.32	3.72	3.59	3.88
Avg. Stack Temp.	°F	563	553	563	560
Stack Flowrate	dscfm	99,747	96,873	90,797	95,806
Isokinetics	%	106	104	107	106
Arsenic (As) --					
Quantity Collected	µg	1.54	0.39	1.14	1.02
Stack Conc. @ 7% O_2	µg/m³	0.56	0.14	0.43	0.38
Stack Emission Rate	lb/hr	2.5E-04	6.4E-05	1.8E-04	1.6E-04
	g/sec	3.1E-05	8.1E-06	2.3E-05	2.07E-05
Beryllium (Be) --					
Quantity Collected	µg	< 0.32	< 0.33	< 0.33	< 0.33
Stack Conc. @ 7% O_2	µg/m³	< 0.12	< 0.12	< 0.12	< 0.12
Stack Emission Rate	lb/hr	< 5.2E-05	< 5.4E-05	< 5.2E-05	< 5.3E-05
	g/sec	< 6.5E-06	< 6.8E-06	< 6.6E-06	< 6.65E-06
Total Chromium (Cr) --					
Quantity Collected	µg	2.81	1.81	1.91	2.18
Stack Conc. @ 7% O_2	µg/m³	1.02	0.66	0.72	0.80
Stack Emission Rate	lb/hr	4.5E-04	3.0E-04	3.0E-04	3.5E-04
	g/sec	5.7E-05	3.8E-05	3.8E-05	4.43E-05
Cadmium (Cd) --					
Quantity Collected	µg	0.07	0.46	0.12	0.22
Stack Conc. @ 7% O_2	µg/m³	0.03	0.17	0.05	0.08
Stack Emission Rate	lb/hr	1.1E-05	7.6E-05	1.9E-05	3.5E-05
	g/sec	1.4E-06	9.5E-06	2.4E-06	4.45E-06
Lead (Pb) --					
Quantity Collected	µg	1.62	1.52	1.92	1.69
Stack Conc. @ 7% O_2	µg/m³	0.59	0.56	0.72	0.62
Stack Emission Rate	lb/hr	2.6E-04	2.5E-04	3.1E-04	2.7E-04
	g/sec	3.3E-05	3.2E-05	3.8E-05	3.43E-05

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Table 5-8 (continued)

Run No.		C2-R1	C2-R2	C2-R3	
Date		07-Jun-06	08-Jun-06	09-Jun-06	
Start Time	Units	10:00	13:20	13:10	
Stop Time		13:25	15:50	15:35	**AVGS**
Sampling Parameters --					
Barometric Pressure	in. Hg	29.68	29.80	29.62	29.70
Volume Metered	dcf	87.815	82.943	80.562	83.773
Sample Volume	dscf	81.739	77.889	75.596	78.408
Moisture	% v/v	17.0	16.0	18.7	17.2
O_2 at Stack	% dry	4.32	3.72	3.59	3.88
Avg. Stack Temp.	°F	563	553	563	560
Stack Flowrate	dscfm	99,747	96,873	90,797	95,806
Isokinetics	%	106	104	107	106
Mercury (Hg) --					
Quantity Collected	µg	9.23	6.49	8.04	7.92
Stack Conc. @ 7% O_2	µg/m³	3.35	2.38	3.02	2.92
Stack Emission Rate	lb/hr	1.5E-03	1.1E-03	1.3E-03	1.3E-03
	g/sec	1.9E-04	1.3E-04	1.6E-04	1.61E-04
Aluminum (Al) --					
Quantity Collected	µg	1,558	1,910	2,081	1,850
Stack Conc. @ 7% O_2	µg/m³	565	702	782	683
Stack Emission Rate	lb/hr	2.5E-01	3.1E-01	3.3E-01	3.0E-01
	g/sec	3.2E-02	4.0E-02	4.2E-02	3.76E-02
Antimony (Sb) --					
Quantity Collected	µg	< 0.22	< 0.09	< 0.15	< 0.15
Stack Conc. @ 7% O_2	µg/m³	< 0.08	< 0.03	< 0.06	< 0.06
Stack Emission Rate	lb/hr	< 3.6E-05	< 1.5E-05	< 2.4E-05	< 2.5E-05
	g/sec	< 4.5E-06	< 1.9E-06	< 3.0E-06	< 3.11E-06
Barium (Ba) --					
Quantity Collected	µg	1.20	0.80	1.40	1.13
Stack Conc. @ 7% O_2	µg/m³	0.44	0.29	0.53	0.42
Stack Emission Rate	lb/hr	1.9E-04	1.3E-04	2.2E-04	1.8E-04
	g/sec	2.4E-05	1.7E-05	2.8E-05	2.30E-05
Cobalt (Co) --					
Quantity Collected	µg	0.78	0.29	0.27	0.45
Stack Conc. @ 7% O_2	µg/m³	0.28	0.11	0.10	0.16
Stack Emission Rate	lb/hr	1.3E-04	4.8E-05	4.3E-05	7.2E-05
	g/sec	1.6E-05	6.0E-06	5.4E-06	9.09E-06

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Table 5-8 (continued)

Run No.		C2-R1	C2-R2	C2-R3	
Date		07-Jun-06	08-Jun-06	09-Jun-06	
Start Time	Units	10:00	13:20	13:10	
Stop Time		13:25	15:50	15:35	**AVGS**
Sampling Parameters --					
Barometric Pressure	in. Hg	29.68	29.80	29.62	29.70
Volume Metered	dcf	87.815	82.943	80.562	83.773
Sample Volume	dscf	81.739	77.889	75.596	78.408
Moisture	% v/v	17.0	16.0	18.7	17.2
O_2 at Stack	% dry	4.32	3.72	3.59	3.88
Avg. Stack Temp.	°F	563	553	563	560
Stack Flowrate	dscfm	99,747	96,873	90,797	95,806
Isokinetics	%	106	104	107	106
Copper (Cu) --					
Quantity Collected	µg	3.58	2.08	2.38	2.68
Stack Conc. @ 7% O_2	µg/m³	1.30	0.76	0.89	0.99
Stack Emission Rate	lb/hr	5.8E-04	3.4E-04	3.8E-04	4.3E-04
	g/sec	7.3E-05	4.3E-05	4.8E-05	5.5E-05
Manganese (Mn) --					
Quantity Collected	µg	1.74	3.74	5.84	3.77
Stack Conc. @ 7% O_2	µg/m³	0.63	1.37	2.19	1.40
Stack Emission Rate	lb/hr	2.8E-04	6.2E-04	9.3E-04	6.1E-04
	g/sec	3.5E-05	7.8E-05	1.2E-04	7.7E-05
Nickel (Ni) --					
Quantity Collected	µg	5.00	4.60	4.00	4.53
Stack Conc. @ 7% O_2	µg/m³	1.81	1.69	1.50	1.67
Stack Emission Rate	lb/hr	8.1E-04	7.6E-04	6.4E-04	7.3E-04
	g/sec	1.0E-04	9.5E-05	8.0E-05	9.2E-05
Selenium (Se) --					
Quantity Collected	µg	133.0	76.5	113.0	107.5
Stack Conc. @ 7% O_2	µg/m³	48.2	28.1	42.5	39.6
Stack Emission Rate	lb/hr	2.1E-02	1.3E-02	1.8E-02	1.7E-02
	g/sec	2.7E-03	1.6E-03	2.3E-03	2.2E-03

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Table 5-8 (continued)

Run No.		C2-R1	C2-R2	C2-R3	
Date		07-Jun-06	08-Jun-06	09-Jun-06	
Start Time	Units	10:00	13:20	13:10	
Stop Time		13:25	15:50	15:35	**AVGS**
Sampling Parameters --					
Barometric Pressure	in. Hg	29.68	29.80	29.62	29.70
Volume Metered	dcf	87.815	82.943	80.562	83.773
Sample Volume	dscf	81.739	77.889	75.596	78.408
Moisture	% v/v	17.0	16.0	18.7	17.2
O_2 at Stack	% dry	4.32	3.72	3.59	3.88
Avg. Stack Temp.	°F	563	553	563	560
Stack Flowrate	dscfm	99,747	96,873	90,797	95,806
Isokinetics	%	106	104	107	106
Silver (Ag) --					
Quantity Collected	µg	2.58	3.98	5.08	3.88
Stack Conc. @ 7% O_2	µg/m³	0.94	1.46	1.91	1.44
Stack Emission Rate	lb/hr	4.2E-04	6.5E-04	8.1E-04	6.3E-04
	g/sec	5.2E-05	8.3E-05	1.0E-04	7.89E-05
Thallium (Tl) --					
Quantity Collected	µg	< 0.32	< 0.33	< 0.33	< 0.33
Stack Conc. @ 7% O_2	µg/m³	< 0.12	< 0.12	< 0.12	< 0.12
Stack Emission Rate	lb/hr	< 5.2E-05	< 5.4E-05	< 5.2E-05	< 5.3E-05
	g/sec	< 6.5E-06	< 6.8E-06	< 6.6E-06	< 6.65E-06
Vanadium (V) --					
Quantity Collected	µg	4.40	5.40	6.90	5.57
Stack Conc. @ 7% O_2	µg/m³	1.60	1.98	2.59	2.06
Stack Emission Rate	lb/hr	7.1E-04	8.9E-04	1.1E-03	9.0E-04
	g/sec	8.9E-05	1.1E-04	1.4E-04	1.1E-04
Zinc (Zn) --					
Quantity Collected	µg	33.1	42.5	47.8	41.1
Stack Conc. @ 7% O_2	µg/m³	12.0	15.6	18.0	15.2
Stack Emission Rate	lb/hr	5.3E-03	7.0E-03	7.6E-03	6.6E-03
	g/sec	6.7E-04	8.8E-04	9.6E-04	8.4E-04

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Table 5-9 Sampling Parameters and Emission Results for Hexavalent Chromium (Condition 2)

Run No. Date Start Time Stop Time	Units	**C2-R1** 07-Jun-06 10:00 13:25	**C2-R2** 08-Jun-06 13:20 15:50	**C2-R3** 09-Jun-06 13:10 15:35	**AVGS**
Sampling Parameters --					
Barometric Pressure	in. Hg	29.68	29.73	29.62	29.68
Volume Metered	dcf	79.565	78.642	88.898	82.368
Sample Volume	dscf	75.811	75.435	85.755	79.001
Moisture	% v/v	23.3	17.7	14.4	18.5
O_2 at Stack	% dry	4.32	3.72	3.59	3.88
Avg. Stack Temp.	°F	569	574	577	574
Stack Flowrate	dscfm	93,490	99,293	108,891	100,558
Isokinetics	%	105	98	102	101
Hexavalent Chromium					
Quantity Collected	µg	0.27	0.15	0.37	0.26
Stack Conc. @ 7% O_2	µg/m³	0.11	0.06	0.12	0.10
Stack Emission Rate	lb/hr	4.4E-05	2.6E-05	6.2E-05	4.4E-05
	g/hr	0.020	0.012	0.028	0.020
	g/sec	5.5E-06	3.3E-06	7.8E-06	5.6E-06

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Table 5-10 Sampling Parameters and Emission Results for PCDDs/PCDFs – TEQ Basis (Condition 2)

	Run No.	C2-R1		C2-R2		C2-R3		
	Date	07-Jun-06		08-Jun-06		09-Jun-06		
	Start Time	16:22		08:00		08:00		
	Stop Time	19:35		11:10		11:54		
	Units							
Sample Volume	dscf	102.824		112.986		105.679		
Sample Volume	m³	2.91		3.20		2.99		
Moisture Content	% v/v	17.2		16.4		17.0		
O_2 Concentration	% v/v (dry)	3.79		3.74		2.59		
CO_2 Concentration	% v/v (dry)	13.66		13.64		11.09		
Isokinetics	%	98		100		95		
Stack Flowrate	dscfm	90,344		96,897		96,058		
PCDD / PCDF Parameters	TEF (a)	pg	ng/m³ TEQ	pg	ng/m³ TEQ	pg	ng/m³ TEQ	
2,3,7,8-TCDD	1.00	(3.93)	0.0E+00	(5.82)	0.0E+00	(3.97)	0.0E+00	
1,2,3,7,8-PeCDD	0.50	(4.19)	0.0E+00	(4.43)	0.0E+00	(4.23)	0.0E+00	
1,2,3,4,7,8-HxCDD	0.10	(7.88)	0.0E+00	(7.63)	0.0E+00	(6.26)	0.0E+00	
1,2,3,6,7,8-HxCDD	0.10	(7.12)	0.0E+00	(6.89)	0.0E+00	(5.66)	0.0E+00	
1,2,3,7,8,9-HxCDD	0.10	(7.32)	0.0E+00	(7.09)	0.0E+00	(5.82)	0.0E+00	
1,2,3,4,6,7,8-HpCDD	0.01	(5.61)	0.0E+00	(5.80)	0.0E+00	(5.75)	0.0E+00	
OCDD	0.001	20.2	6.9E-06	(10.6)	0.0E+00	17.0	5.7E-06	
2,3,7,8-TCDF	0.10	(4.26)	0.0E+00	(5.07)	0.0E+00	(5.92)	0.0E+00	
1,2,3,7,8-PeCDF	0.05	(5.20)	0.0E+00	(6.87)	0.0E+00	(6.94)	0.0E+00	
2,3,4,7,8-PeCDF	0.50	(4.89)	0.0E+00	(6.46)	0.0E+00	(6.53)	0.0E+00	
1,2,3,4,7,8-HxCDF	0.10	(2.54)	0.0E+00	(2.53)	0.0E+00	(2.70)	0.0E+00	
1,2,3,6,7,8-HxCDF	0.10	(2.34)	0.0E+00	(2.33)	0.0E+00	(4.09)	0.0E+00	
2,3,4,6,7,8-HxCDF	0.10	(2.58)	0.0E+00	(2.57)	0.0E+00	(2.74)	0.0E+00	
1,2,3,7,8,9-HxCDF	0.10	(2.82)	0.0E+00	(2.81)	0.0E+00	(3.00)	0.0E+00	
1,2,3,4,6,7,8-HpCDF	0.01	(3.52)	0.0E+00	(4.30)	0.0E+00	(5.22)	0.0E+00	
1,2,3,4,7,8,9-HpCDF	0.01	(4.23)	0.0E+00	(5.17)	0.0E+00	(6.28)	0.0E+00	
OCDF	0.001	35.3	1.2E-05	34.9	1.1E-05	41.4	1.4E-05	
TOTAL TEQs (ng/m³)	=		1.9E-05		1.1E-05		2.0E-05	**AVG:**
TOTAL TEQs (ng/m³ @ 7 % O_2)	=		**1.6E-05**		**8.8E-06**		**1.5E-05**	**1.3E-05**
TOTAL TEQs (g/s)	=		8.1E-13		5.0E-13		8.8E-13	

(a) U.S.EPA (1989) Toxic Equivalency Factor

Note: "Non-detect" values are shown in parentheses and treated as zero in the calculation of concentration on a TEQ basis.

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Table 5-11 Sampling Parameters and Emission Results for PAHs (Condition 2)

	Run No.	C2-R1		C2-R2		C2-R3	
	Date	07-Jun-06		08-Jun-06		09-Jun-06	
	Start Time	16:22		08:00		08:00	
	Stop Time	19:35		11:10		11:54	
	Units						
Sample Volume	dscf	102.824		112.986		105.679	
Sample Volume	m^3	2.912		3.20		2.99	
Moisture Content	% v/v	17.2		16.4		17.0	
O_2 Concentration	% v/v (dry)	3.8		3.7		2.6	
CO_2 Concentration	% v/v (dry)	13.7		13.6		11.1	
Isokinetics	%	98		100		95	
Stack Flowrate	dscfm	90,344		96,897		96,058	
Noncarcinogenic PAHs:		ng	g/sec	ng	g/sec	ng	g/sec
Naphthalene		(755)	1.1E-05	(755)	1.1E-05	**755**	1.1E-05
2-Methylnaphthalene		(215)	3.1E-06	(215)	3.1E-06	**218**	3.3E-06
Acenaphthylene		(20.0)	2.9E-07	(20.0)	2.9E-07	(20.0)	3.0E-07
Acenaphthene		(20.0)	2.9E-07	(20.0)	2.9E-07	(20.0)	3.0E-07
Fluorene		(20.0)	2.9E-07	**23.0**	3.3E-07	**85.1**	1.3E-06
Phenanthrene		(50.0)	7.3E-07	(50.0)	7.1E-07	**61.8**	9.4E-07
Anthracene		(20.0)	2.9E-07	(20.0)	2.9E-07	**58.7**	8.9E-07
Fluoranthene		(20.0)	2.9E-07	(20.0)	2.9E-07	(20.0)	3.0E-07
Pyrene		(20.0)	2.9E-07	(20.0)	2.9E-07	(20.0)	3.0E-07
Benzo(e)pyrene		(20.0)	2.9E-07	(20.0)	2.9E-07	(20.0)	3.0E-07
Perylene		(20.0)	2.9E-07	(20.0)	2.9E-07	(20.0)	3.0E-07
Benzo(g,h,i)perylene		(20.0)	2.9E-07	(20.0)	2.9E-07	(20.0)	3.0E-07
Carcinogenic PAHs:		ng	g/sec	ng	g/sec	ng	g/sec
Benzo(a)anthracene		(20.0)	2.9E-07	(20.0)	2.9E-07	(20.0)	3.0E-07
Chrysene		(20.0)	2.9E-07	(20.0)	2.9E-07	(20.0)	3.0E-07
Benzo(b)fluoranthene		(20.0)	2.9E-07	(20.0)	2.9E-07	(20.0)	3.0E-07
Benzo(k)fluoranthene		(20.0)	2.9E-07	(20.0)	2.9E-07	(20.0)	3.0E-07
Benzo(a)pyrene		(20.0)	2.9E-07	(20.0)	2.9E-07	(20.0)	3.0E-07
Indeno(1,2,3-c,d)pyrene		(20.0)	2.9E-07	(20.0)	2.9E-07	(20.0)	3.0E-07
Dibenz(a,h)anthracene		(20.0)	2.9E-07	(20.0)	2.9E-07	(20.0)	3.0E-07

Note: "Non-detect" values are shown in parentheses and used in the calculation of emission rate.

C:\PROJECTS\ShellCA\Trial Burn Mgmt\Field\[M23 DF PAH C2.xls]PAHs

Table 5-12 Sampling Parameters and Emission Results for Semivolatile Organics (Condition 2)

	Run No.	C2-R1		C2-R2		C2-R3	
	Date	07-Jun-06		08-Jun-06		09-Jun-06	
	Start Time	16:22		08:00		08:00	
	Stop Time	19:35		11:10		11:10	
	Units						
Sample Volume	dscf	105.670		103.287		110.108	
Sample Volume	m^3	2.99		2.92		3.12	
Moisture Content	% v/v	18.1		17.9		18.1	
O_2 Conc.	% v/v (dry)	3.79		3.74		2.59	
CO_2 Conc.	% v/v (dry)	13.66		13.64		11.09	
Isokinetics	%	101		94		101	
Stack Flowrate	dscfm	90,224		94,832		94,139	
Semivolatile Organics:		**µg**	**g/sec**	**µg**	**g/sec**	**µg**	**g/sec**
N-Nitrosodiethylamine		30	4.3E-04	30	4.6E-04	30	4.3E-04
Aniline		30	4.3E-04	30	4.6E-04	30	4.3E-04
Benzidine		300	4.3E-03	300	4.6E-03	300	4.3E-03
Benzoic acid		150	2.1E-03	146	2.2E-03	**190**	2.7E-03
bis(2-Chloroethoxy)methane		30	4.3E-04	30	4.6E-04	30	4.3E-04
bis(2-Chloroethyl) ether		30	4.3E-04	30	4.6E-04	30	4.3E-04
bis(2-Chloroisopropyl) ether		30	4.3E-04	30	4.6E-04	30	4.3E-04
bis(2-Ethylhexyl) phthalate		22	3.1E-04	30	4.6E-04	14.3	2.0E-04
4-Bromophenyl phenyl ether		30	4.3E-04	30	4.6E-04	30	4.3E-04
Butyl benzyl phthalate		30	4.3E-04	30	4.6E-04	30	4.3E-04
4-Chloroaniline		30	4.3E-04	30	4.6E-04	30	4.3E-04
4-Chloro-3-methylphenol		150	2.1E-03	150	2.3E-03	150	2.1E-03
2-Chloronaphthalene		30	4.3E-04	30	4.6E-04	30	4.3E-04
2-Chlorophenol		30	4.3E-04	30	4.6E-04	30	4.3E-04
4-Chlorophenyl phenyl ether		30	4.3E-04	30	4.6E-04	30	4.3E-04
Di-n-butyl phthalate		30	4.3E-04	30	4.6E-04	24	3.4E-04
1,2-Dichlorobenzene		30	4.3E-04	30	4.6E-04	30	4.3E-04
1,3-Dichlorobenzene		30	4.3E-04	30	4.6E-04	30	4.3E-04
1,4-Dichlorobenzene		30	4.3E-04	30	4.6E-04	30	4.3E-04
3,3'-Dichlorobenzidine		30	4.3E-04	30	4.6E-04	30	4.3E-04
2,4-Dichlorophenol		30	4.3E-04	30	4.6E-04	30	4.3E-04
Diethyl phthalate		30	4.3E-04	30	4.6E-04	30	4.3E-04
2,4-Dimethylphenol		30	4.3E-04	30	4.6E-04	30	4.3E-04
Dimethyl phthalate		30	4.3E-04	30	4.6E-04	30	4.3E-04
4,6-Dinitro-2-methylphenol		150	2.1E-03	150	2.3E-03	150	2.1E-03

Note: Only benzoic acid was detected above its reporting limit (RL) (C2-R3).

Pg 1 of 2

C:\PROJECTS\ShellCA\Trial Burn Mgmt\Field\[M10 SVOCs C2.xls]SVOCsPg1

Table 5-12 (continued)

	Run No.	C2-R1		C2-R2		C2-R3	
	Date	07-Jun-06		08-Jun-06		09-Jun-06	
	Start Time	16:22		08:00		08:00	
	Stop Time	19:35		11:10		11:10	
	Units						
Sample Volume	dscf	105.670		103.287		110.108	
Sample Volume	m^3	2.99		2.92		3.12	
Moisture Content	% v/v	18.1		17.9		18.1	
O_2 Conc.	% v/v (dry)	3.79		3.74		2.59	
CO_2 Conc.	% v/v (dry)	13.66		13.64		11.09	
Isokinetics	%	101		94		101	
Stack Flowrate	dscfm	90,224		94,832		94,139	
Semivolatile Organics:		**µg**	**g/sec**	**µg**	**g/sec**	**µg**	**g/sec**
2,4-Dinitrophenol		150	2.1E-03	150	2.3E-03	150	2.1E-03
2,4-Dinitrotoluene		30	4.3E-04	30	4.6E-04	30	4.3E-04
2,6-Dinitrotoluene		30	4.3E-04	30	4.6E-04	30	4.3E-04
Di-n-octyl phthalate		30	4.3E-04	30	4.6E-04	30	4.3E-04
Hexachlorobenzene		30	4.3E-04	30	4.6E-04	30	4.3E-04
Hexachlorobutadiene		30	4.3E-04	30	4.6E-04	30	4.3E-04
Hexachlorocyclopentadiene		150	2.1E-03	150	2.3E-03	150	2.1E-03
Hexachloroethane		30	4.3E-04	30	4.6E-04	30	4.3E-04
Isophorone		30	4.3E-04	30	4.6E-04	30	4.3E-04
2-Methylphenol		60	8.5E-04	60	9.2E-04	60	8.5E-04
2-Nitroaniline		30	4.3E-04	30	4.6E-04	30	4.3E-04
3-Nitroaniline		30	4.3E-04	30	4.6E-04	30	4.3E-04
4-Nitroaniline		150	2.1E-03	150	2.3E-03	150	2.1E-03
Nitrobenzene		30	4.3E-04	30	4.6E-04	30	4.3E-04
2-Nitrophenol		150	2.1E-03	150	2.3E-03	150	2.1E-03
4-Nitrophenol		150	2.1E-03	150	2.3E-03	150	2.1E-03
N-Nitrosodimethylamine		30	4.3E-04	30	4.6E-04	30	4.3E-04
N-Nitrosodiphenylamine		30	4.3E-04	30	4.6E-04	30	4.3E-04
N-Nitrosodi-n-propylamine		30	4.3E-04	30	4.6E-04	30	4.3E-04
Pentachlorophenol		150	2.1E-03	150	2.3E-03	150	2.1E-03
Phenol		150	2.1E-03	150	2.3E-03	150	2.1E-03
1,2,4-Trichlorobenzene		30	4.3E-04	30	4.6E-04	30	4.3E-04
2,4,5-Trichlorophenol		30	4.3E-04	30	4.6E-04	30	4.3E-04
2,4,6-Trichlorophenol		150	2.1E-03	150	2.3E-03	150	2.1E-03

Note: No compounds were detected above the reporting limit (RL). **Pg 2 of 2**

C:\PROJECTS\ShellCA\Trial Burn Mgmt\Field\[M10 SVOCs C2.xls]SVOCsPg2

Table 5-13 VOST Sampling Parameters (Condition 2)

Date	Bar. Press. in Hg	Run ID No.	Sampling Times		Sample Volume aL	Meter Temp. °C	Sample Volume dsL
			Start	Stop			
7-Jun-06	29.68	1A	16:50	17:10	20.020	13.5	20.411
7-Jun-06	29.68	1B	17:30	17:50	20.480	17.1	20.621
7-Jun-06	29.68	1C	18:00	18:20	22.970	17.1	23.128
7-Jun-06	29.68	1D	18:28	18:48	19.580	17.8	19.667
7-Jun-06	29.68	1E	18:58	19:18	21.290	17.1	21.436
8-Jun-06	29.71	2A	08:40	09:00	20.270	14.7	20.597
8-Jun-06	29.71	2B	09:04	09:24	25.460	16.1	25.747
8-Jun-06	29.71	2C	09:30	09:50	23.110	16.7	23.326
8-Jun-06	29.71	2D	10:00	10:20	19.950	16.3	20.165
9-Jun-06	29.65	3A	09:40	10:00	18.630	10.7	19.161
9-Jun-06	29.65	3B	10:08	10:28	18.770	13.5	19.118
9-Jun-06	29.65	3C	10:38	10:58	20.170	17.4	20.268
9-Jun-06	29.65	3D	11:06	11:26	20.210	17.2	20.318
DGM Y =	1.0049						

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Table 5-14 Emission Results for Target Volatile Organics (Condition 2)

	Run No.	**C2-R1**	Run No.	**C2-R2**	Run No.	**C2-R3**
	Date	07-Jun-06	Date	08-Jun-06	Date	09-Jun-06
	Start Time	16:50	Start Time	08:40	Start Time	09:40
	Stop Time	18:48	Stop Time	10:20	Stop Time	11:26
VOST Sample Volume, dsL		84.852		89.835		78.865
VOST Pairs Analyzed		b, c, d, e		a, b, c, d		a, b, c, d
Stack Flowrate, dscfm		90,284		95,865		95,099
Volatile Organics:	µg	g/sec	µg	g/sec	µg	g/sec
Acetone	0.687	3.4E-04	0.811	4.1E-04	0.890	5.1E-04
Acrylonitrile	3.000	1.5E-03	2.500	1.3E-03	4.000	2.3E-03
Benzene	0.080	4.0E-05	0.090	4.5E-05	0.162	9.2E-05
Bromobenzene	0.150	7.5E-05	0.125	6.3E-05	0.200	1.1E-04
Bromochloromethane	0.150	7.5E-05	0.125	6.3E-05	0.200	1.1E-04
Bromodichloromethane	0.150	7.5E-05	0.125	6.3E-05	0.200	1.1E-04
Bromoform	0.150	7.5E-05	0.125	6.3E-05	0.200	1.1E-04
Bromomethane	0.249	1.3E-04	0.250	1.3E-04	0.368	2.1E-04
2-butanone	0.600	3.0E-04	0.500	2.5E-04	0.800	4.6E-04
n-Butylbenzene	0.150	7.5E-05	0.125	6.3E-05	0.200	1.1E-04
sec-Butylbenzene	0.150	7.5E-05	0.125	6.3E-05	0.200	1.1E-04
tert-Butylbenzene	0.150	7.5E-05	0.125	6.3E-05	0.200	1.1E-04
Carbon disulfide	0.111	5.6E-05	0.104	5.3E-05	0.200	1.1E-04
Carbon tetrachloride	0.135	6.8E-05	0.089	4.5E-05	0.200	1.1E-04
Chlorobenzene	0.150	7.5E-05	0.125	6.3E-05	0.200	1.1E-04
Chlorodibromomethane	0.150	7.5E-05	0.125	6.3E-05	0.200	1.1E-04
Chloroethane	0.300	1.5E-04	0.250	1.3E-04	0.400	2.3E-04
Chloroform	0.150	7.5E-05	0.125	6.3E-05	0.200	1.1E-04
Chloromethane	0.291	1.5E-04	0.170	8.6E-05	0.290	1.7E-04
2-Chlorotoluene	0.150	7.5E-05	0.125	6.3E-05	0.200	1.1E-04
4-Chlorotoluene	0.150	7.5E-05	0.125	6.3E-05	0.200	1.1E-04
1,2-Dibromo-3-chloropropane	0.300	1.5E-04	0.250	1.3E-04	0.400	2.3E-04
1,2-Dibromoethane	0.150	7.5E-05	0.125	6.3E-05	0.200	1.1E-04
Dibromomethane	0.150	7.5E-05	0.125	6.3E-05	0.200	1.1E-04
1,2-Dichlorobenzene	0.150	7.5E-05	0.125	6.3E-05	0.200	1.1E-04
1,3-Dichlorobenzene	0.150	7.5E-05	0.125	6.3E-05	0.200	1.1E-04
1,4-Dichlorobenzene	0.150	7.5E-05	0.125	6.3E-05	0.200	1.1E-04
Dichlorodifluoromethane	0.102	5.1E-05	0.201	1.0E-04	0.200	1.1E-04
1,1-Dichloroethane	0.150	7.5E-05	0.125	6.3E-05	0.200	1.1E-04
1,2-Dichloroethane	0.150	7.5E-05	0.125	6.3E-05	0.200	1.1E-04
cis-1,2-Dichloroethene	0.150	7.5E-05	0.125	6.3E-05	0.200	1.1E-04
trans-1,2-Dichloroethene	0.150	7.5E-05	0.125	6.3E-05	0.200	1.1E-04
1,1-Dichloroethene	0.150	7.5E-05	0.125	6.3E-05	0.200	1.1E-04

Note: Although only relatively few compounds were detected (see Appendix E), the above calculations sum all "ND" and "real" values together (all sample fractions) to yield a "worst-case" emission rate.

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Table 5-14 (continued)

	Run No.	**C2-R1**	Run No.	**C2-R2**	Run No.	**C2-R3**
	Date	07-Jun-06	Date	08-Jun-06	Date	09-Jun-06
	Start Time	16:50	Start Time	8:40	Start Time	9:40
	Stop Time	18:48	Stop Time	10:20	Stop Time	11:26
VOST Sample Volume, dsL		84.852		89.835		78.865
VOST Pairs Analyzed		b, c, d, e		a, b, c, d		a, b, c, d
Stack Flowrate, dscfm		90,284		95,865		95,099
Volatile Organics:	µg	g/sec	µg	g/sec	µg	g/sec
1,2-Dichloropropane	0.150	7.5E-05	0.125	6.3E-05	0.200	1.1E-04
1,3-Dichloropropane	0.150	7.5E-05	0.125	6.3E-05	0.200	1.1E-04
2,2-Dichloropropane	0.150	7.5E-05	0.125	6.3E-05	0.200	1.1E-04
cis-1,3-Dichloropropene	0.150	7.5E-05	0.125	6.3E-05	0.200	1.1E-04
trans-1,3-Dichloropropene	0.150	7.5E-05	0.125	6.3E-05	0.200	1.1E-04
1,1-Dichloropropene	0.150	7.5E-05	0.125	6.3E-05	0.200	1.1E-04
Ethylbenzene	0.150	7.5E-05	0.125	6.3E-05	0.200	1.1E-04
Hexachlorobutadiene	0.150	7.5E-05	0.125	6.3E-05	0.200	1.1E-04
2-Hexanone	0.600	3.0E-04	0.500	2.5E-04	0.800	4.6E-04
Isopropylbenzene	0.150	7.5E-05	0.125	6.3E-05	0.200	1.1E-04
p-Isopropyltoluene	0.150	7.5E-05	0.125	6.3E-05	0.200	1.1E-04
Methylene chloride	0.222	1.1E-04	0.180	9.1E-05	4.157	2.4E-03
4-Methyl-2-pentanone	0.600	3.0E-04	0.500	2.5E-04	0.800	4.6E-04
n-Propylbenzene	0.150	7.5E-05	0.125	6.3E-05	0.200	1.1E-04
Styrene	0.150	7.5E-05	0.125	6.3E-05	0.200	1.1E-04
1,1,1,2-Tetrachloroethane	0.150	7.5E-05	0.125	6.3E-05	0.200	1.1E-04
1,1,2,2-Tetrachloroethane	0.150	7.5E-05	0.125	6.3E-05	0.200	1.1E-04
Tetrachloroethene	0.100	5.0E-05	0.087	4.4E-05	0.200	1.1E-04
Toluene	0.049	2.4E-05	0.068	3.4E-05	0.170	9.7E-05
1,2,3-Trichlorobenzene	0.150	7.5E-05	0.125	6.3E-05	0.200	1.1E-04
1,2,4-Trichlorobenzene	0.150	7.5E-05	0.125	6.3E-05	0.200	1.1E-04
1,1,1-Trichloroethane	0.150	7.5E-05	0.125	6.3E-05	0.200	1.1E-04
1,1,2-Trichloroethane	0.150	7.5E-05	0.125	6.3E-05	0.200	1.1E-04
Trichloroethene	0.150	7.5E-05	0.125	6.3E-05	0.200	1.1E-04
Trichlorofluoromethane	0.300	1.5E-04	0.143	7.2E-05	0.400	2.3E-04
1,2,3-Trichloropropane	0.150	7.5E-05	0.125	6.3E-05	0.200	1.1E-04
1,2,4-Trimethylbenzene	0.150	7.5E-05	0.125	6.3E-05	0.200	1.1E-04
1,3,5-Trimethylbenzene	0.150	7.5E-05	0.125	6.3E-05	0.200	1.1E-04
Vinyl Chloride	0.150	7.5E-05	0.125	6.3E-05	0.200	1.1E-04
m-Xylene & p-Xylene	0.300	1.5E-04	0.169	8.5E-05	0.400	2.3E-04
o-Xylene	0.150	7.5E-05	0.125	6.3E-05	0.200	1.1E-04

Note: Although only relatively few compounds were detected (see Appendix E), the above calculations sum all "ND" and "real" values together (all sample fractions) to yield a "worst-case" emission rate.

C:\PROJECTS\ShellCA\Trial Burn Mgmt\Field\[VOST VOCs C2.xls]EMISS PG2 **Pg 2 of 2**

Table 5-15 VOST Sampling Parameters (Condition 3)

Date	Bar. Press. in Hg	Run ID No.	Sampling Times		Sample Volume aL	Meter Temp. °C	Sample Volume dsL
			Start	Stop			
13-Jun-06	29.83	1A	10:30	10:50	19.440	19.0	19.541
13-Jun-06	29.83	1B	11:12	11:32	19.900	18.6	20.032
13-Jun-06	29.83	1C	11:44	12:04	20.070	18.2	20.232
13-Jun-06	29.83	1D	12:15	12:35	19.970	18.8	20.093
13-Jun-06	29.83	2A	12:55	13:15	19.120	16.5	19.386
13-Jun-06	29.83	2B	13:28	13:48	20.060	17.6	20.261
13-Jun-06	29.83	2C	14:02	14:22	19.680	18.6	19.811
13-Jun-06	29.83	2D	14:39	14:59	20.600	19.3	20.688
13-Jun-06	29.83	3A	15:16	15:36	20.200	18.1	20.373
13-Jun-06	29.83	3B	15:50	16:10	19.380	18.2	19.537
13-Jun-06	29.83	3C	16:23	16:43	19.490	18.1	19.653
13-Jun-06	29.83	3D	16:55	17:15	20.590	18.3	20.747
DGM Y =	1.0049						

C:\PROJECTS\ShellCA\Trial Burn Mgmt\Field\[VOST DRE C3.xls]PARAM C3

Table 5-16 DRE Calculations for Monochlorobenzene (Condition 3)

POHC Feed Parameters				Stack Gas Parameters					
Run No.	Run Date Start Time Stop Time	(a) POHC Purity (% wt)	POHC Spike Rate (lb/hr)	VOST Run No.	Volume Sampled (dsL)	POHC Quantity Detected (µg)	(b) Stack Gas Flowrate (dscfm)	POHC Emission Rate (lb/hr)	Calculated DRE
C3-R1	13-Jun-06 10:30 12:35			1-A	19.541				
				1-B	20.032				
				1-C	20.232				
				1-D	20.093				
Overall C3-R1:		**99.9986%**	**75.0**		**79.899**	**0.960**	**147,935**	**6.66E-03**	**99.9911%**
C3-R2	13-Jun-06 12:55 14:59			2-A	19.386				
				2-B	20.261				
				2-C	19.811				
				2-D	20.688				
Overall C3-R2:		**99.9986%**	**75.0**		**80.145**	**4.665**	**144,568**	**3.15E-02**	**99.9580%**
C3-R3	13-Jun-06 15:16 17:15			3-A	20.373				
				3-B	19.537				
				3-C	19.653				
				3-D	20.747				
Overall C2-R3:		**99.9986%**	**75.0**		**80.310**	**6.625**	**139,804**	**4.32E-02**	**99.9424%**
				AVG DRE, RUNS C3-R1 -- C3-R3 :					**99.9638%**

C:\PROJECTS\ShellCA\Trial Burn Mgmt\Field\[VOST DRE C3.xls]POHC DRE

(a) POHC purity is provided for information only; the spike rate provided by Triad already accounts for POHC purity.

(b) The stack gas flowrate used for the VOST runs is taken from the Method 2 / 4 trains run concurrently.

6.0 Quality Assurance / Quality Control (QA/QC)

This trial burn program incorporated a variety of QA/QC measures to ensure the validity of the final results for documentation of the performance of Shell's CO boiler unit. These measures were based upon routine field and laboratory practices as well as specific requirements delineated in the approved Trial Burn Plan and the applicable sampling and analytical protocols.

This section presents the results of all QA/QC measures evaluated during both the field sampling program and during all phases of sample analysis. Data generated for the program are judged to be completely valid since overall accuracy and precision goals consistent with general program objectives were achieved. Analytical QA/QC data are presented to support all sample results used for determining compliance with performance criteria and/or emission standards.

6.1 Sample Collection QA/QC

6.1.1 Waste Feed Stream

Samples of the waste feed material were collected at the beginning, middle and end of each run as specified in Section 5.4.4 of the TBP. Field data sheets were completed by the sampler (Shell personnel) and are included in Appendix D. No problems were encountered during any periods of waste sample collection.

6.1.2 Stack Gas

All samples were collected at the stack sampling platform on COB-2 as planned. One (1) field blank of each isokinetic sampling train was also submitted for analysis. For the VOST methodology, multiple field blanks (one per day of testing) and 2 trip blanks were also submitted along with program samples. In addition, DTSC provided a VOST audit cylinder which was sampled at the conclusion of testing on June 14, 2006. These VOST audit samples were submitted for analysis along with the routine program samples collected.

Sampling QA/QC measures for this program included the calibration of all applicable sampling equipment according to EPA procedures identified in 40 CFR 60, Methods 1-5, as well as manufacturer's specifications. Details of specific calibrations are summarized in Appendix B of Avogadro's report contained in Appendix B of this trial burn report.

Chain-of-custody (COC) procedures for all stack samples was initiated and maintained as follows:

- Samples were collected, sealed and labeled with preprinted sample labels. Each isokinetic train was setup and recovered in either the Avogadro mobile trailer set up in close proximity to the tested unit or at Avogadro's nearby facility in Martinez, CA.
- Preprinted sample lists were used to check that all samples were collected and each container was checked upon completion of recovery and labeling.
- All samples were packed in bubble wrap or other absorbent material and placed in either sample coolers or appropriate DOT shipping packages (dangerous goods items). All samples were subsequently driven by ENSR or Avogadro or shipped via Priority Overnight FedEx service to the designated laboratory.

6.2 Laboratory Analysis QA/QC

This section provides a detailed presentation of QA/QC results from sample analysis as reported by each analytical laboratory. Key QC data related to matrix spikes, surrogate spikes, duplicate analyses, laboratory control samples (blank spikes), method blanks and/or field blank results are presented in tabular format. Other QC procedures followed such as calibration checks and additional method-specific protocols are described in the case narratives and analytical data packages provided in Appendix E. Also, unless noted otherwise, all holding times and method-specific QC criteria were met and reported results met all applicable NELAC requirements.

6.2.1 Waste Feed Stream – Physical Parameter Analyses

Evaluation of the validity of the physical parameter analyses was based on the following QA objectives:

- Results of analysis of laboratory control samples (LCS) for density and total chlorine.
- Results of duplicate sample analyses (LCS / LCSD) for ash and heat content and duplicate analyses performed for all parameters.
- Results of a matrix spike and matrix spike duplicate (MS / MSD) for total chlorine.
- Results of analysis of method blanks.

Results summarized in **Table 6-1** indicate that only the duplicate chloride analysis was outside control limits, but since both the initial sample result and the duplicate result were close to the reporting limit, this is not deemed to be significant. Therefore, program quality objectives were met and completeness was determined to be 100% for all waste feed physical parameter (total chlorides, ash, moisture, density and heat content) analyses.

Table 6-1 Overall QC Summary for Waste Feed Stream Physical Parameter Analyses

QC Parameter	Target Criteria	Program Results
Method Blanks (ash and total chlorides)	Below detection limit	Non detect for both parameters
Duplicate Analyses (all parameters)	< 30 % RPD	All within control limits, except slightly high result for total chlorides
Matrix Spikes (MS) and Matrix Spike Duplicates (MSD) (total chlorides)	< 30 % RPD	All recoveries within limits
Lab Control Samples (LCS) and Associated Duplicates (LCSD)	90 – 110% recovery and < 30 % RPD	All recoveries within limits

6.2.2 Waste Feed Stream – Organic Analyses

Evaluation of the validity of the volatile and semivolatile organic analyses performed on the waste material was based on the following QA objectives:

- Results of analysis of LCS (or blank spikes).
- Results of analysis of MS / MSD or LCS / LCSD.
- Results for recoveries of 4 volatile surrogates and 8 semivolatile surrogates spiked into all samples prior to analysis.
- Results of analysis of method blanks.

These samples required very high dilutions (500x for VOCs and 200-500x for SVOCs) in order to effectively report sample results. This resulted in elevated reporting limits for both VOC and SVOC analyses and inability to calculate surrogate recoveries for the SVOC analyses because the surrogate spike levels were so much lower than the reported result. Results summarized in **Table 6-2** indicate that all other program quality objectives were met and that completeness was therefore determined to be 100% for all waste feed analyses.

Table 6-2 Overall QC Summary for Waste Feed Stream Organic Analyses

QC Parameter	Target Criteria	Program Results
Method Blanks	Below detection limit	No compounds reported above the reporting limit
Surrogate Recoveries	Variable depending upon the specific compound	All recoveries within limits for VOC analyses. Not calculated for SVOC analyses.
Matrix Spikes / Matrix Spike Duplicates or LCS / LCSD	< 35 % RPD	All precision goals met
Lab Control Samples	50 – 130% recovery	All recoveries within limits

6.2.3 Waste Feed Stream – Metals Analyses

Evaluation of the validity of the waste stream metals analyses was based on the following QA objectives:

- Results of analysis of LCS and MS.
- Results of analysis of duplicate analyses, MS / MSD and/or LCS / LCSD.
- Results of analysis of method blanks.

Results for the majority of elements in the matrix spikes were not calculated due to the high concentration of these analytes in the sample relative to the spiking solution (greater than 4x). The remainder of the elements had low recoveries, but the LCS was in control indicating a matrix effect rather than a method performance problem. Results summarized in **Table 6-3** indicate that remaining program quality objectives were met and that completeness was therefore determined to be 100% for all waste feed analyses.

Table 6-3 Overall QC Summary for Waste Feed Stream Metals Analyses

QC Parameter	Target Criteria	Program Results
Method Blank	Below detection limit	Non detect for all parameters
MS / MSD, Duplicate Analyses or LCS / LCSD	< 35 % RPD	Not calculated for the majority of elements due to the high concentration of the analytes relative to the spiking solution
Lab Control Samples	70 – 130% Recovery	All recoveries within limits

6.2.4 Stack Gas Analyses

6.2.4.1 Particulate Matter

Evaluation of results of gravimetric analysis of the Method 5 (Condition 1) and Method 0050 (Condition 2) samples was based on routine laboratory practices and processing of lab blank and field blank samples. Front-half rinse sample fractions underwent blank correction at Avogadro up to the maximum allowed by the method (0.01 mg/g). The blank filter weights were within acceptable tolerances and required no blank correction. Additional QC measures followed by the gravimetric lab, such as maintenance of proper ambient conditions and use of standard weights, ensured valid data.

6.2.4.2 Hydrogen Chloride, Chlorine and Ammonia

Evaluation of the validity of anion analysis of Method 0050 train samples was based on three sets of objectives. These were:

- Results of analysis of LCS and matrix spikes.
- Results from the duplicate analysis of all samples.
- Results of analysis of field and method blank samples.

Matrix spike recoveries for ammonia were not calculated due to the high level of this analyte in the samples relative to the spike (greater than 4x). The associated LCS was in control. Target criteria and results are shown in **Table 6-4**. All other results met trial burn data quality objectives and completeness was therefore determined to be 100% for these parameters.

Table 6-4 Overall QC Summary for HCl, Cl_2 and NH_3 in Stack Gas Samples

QC Parameter	Target Criteria	Program Results
Field Blanks	Below detection limit	ND for HCl and Cl_2; NH_3 detected at a level slightly above the RL
Method Blank	Below detection limit	All parameters ND
Accuracy - LCS Recoveries	90%-110% recovery	All samples within limits
Accuracy - MS Recoveries	70%-130% recovery	HCl and Cl_2 within limits; NH_3 not calculated due to the high levels in the sample relative to the spike (> 4x)
Precision - LCS / LCSD, MS / MSD and Duplicate Analyses	< 35 % RPD	All samples within limits

6.2.4.3 Carbonyl Compounds

Evaluation of the validity of the aldehyde emission data resultant from the analysis of the Method 0011 samples was based on the following data quality objectives:

- Recoveries of an in-house spike (LCS) for formaldehyde.
- Results of analysis of a field spike for formaldehyde.
- Results of duplicate analysis of the C2-R2 sample for all target analytes.
- Results of analysis of a field blank and a lab blank for all target analytes.

On the basis of the results presented in **Table 6-5**, all results were determined to be valid and completeness was therefore determined to be 100% for all target aldehyde analytical results.

Table 6-5 Overall QC Summary for Aldehydes in Stack Gas Samples

QC Parameter	Target Criteria	Program Results
Field Blank	Below detection Limit	All compounds below RL.
Lab Blank (Acetonitrile used to reconstitute the DNPH reagent)	Below detection Limit	Non detect for all parameters
Accuracy - Field Spike Recovery	70 – 130% recovery	102% recovery for formaldehyde
Duplicate Analysis of one run (C2-R2)	Less than 25% RPD	All parameters within limits
Lab Control Sample (In-House Spike into DNPH)	70 – 130% recovery	96.8% recovery for formaldehyde

6.2.4.4 Metals

Evaluation of the validity of the metals data resultant from the analysis of the Method 29 sampling trains was based on the following data quality objectives:

- Results of analysis of post-digestion spikes for all target metals.
- Results of analysis of samples analyzed in duplicate and blank spike recoveries.
- Results of analyses of field and method blank samples.

Post-spike recoveries for aluminum were not calculated due to the high level of this analyte in the sample relative to the spike (> 4x). Data summarized in **Table 6-6** show that no other problems were encountered during sample analysis and all metals train data were therefore judged to be completely acceptable.

Table 6-6 Overall QC Summary for Metals in Stack Gas Samples

QC Parameter	Target Criteria	Program Results
Field Blank	Below detection limit	Aluminum, barium, chromium, manganese and zinc all reported above the reporting limit. Final results have been blank-corrected to the maximum extent allowed in accordance with method specific procedures.
Method Blank	Below Detection Limit	No metals detected above the reporting limit
Accuracy – LCS Recoveries	70%-130% Recovery	All metals within limits
Precision – LCS / LCSD	Less than 35% RPD	All metals within limits
Accuracy – Post-Digestion Matrix Spike for Method 6020 metals	70%-130% Recovery	All metals within limits, except not calculated for aluminum
Precision – Post-Digestion Matrix Spike for Method 6020 metals	Less than 35% RPD	All metals within limits, except not calculated for aluminum
Accuracy – Matrix Spike for Mercury (Back-Half)	70%-130% Recovery	Parameter within limits
Precision – Matrix Spike for Mercury (Back-Half)	Less than 35% RPD	Parameter within limits

6.2.4.5 Hexavalent Chromium

Evaluation of the validity of the data resultant from the analysis of the Method 0061 sampling train samples was based on the following QC indicators:

- Recoveries of lab blank (LCS) and matrix spikes.
- Duplicate analysis of all samples.
- Results of analysis of field and method blank samples.

As shown in **Table 6-7**, all recoveries in the LCSs and matrix spikes met the target criteria and results of all duplicate analyses were within method-specified criteria. Also, field and method blanks were free of the target analyte. Therefore, no sample analyses were rejected and completeness was determined to be 100% for all hexavalent chromium results.

Table 6-7 Overall QC Summary for Hexavalent Chromium in Stack Gas Samples

QC Parameter	Target Criteria	Program Results
Holding Time	Analyze within 14 days of sample collection	All samples analyzed within target holding time
Field Blank	Below Detection Limit	Reported as ND
Method Blank	Below Detection Limit	Reported as ND
Lab Control Sample	90%-110% Recovery	All samples within limits.
Matrix Spike	70%-130% Recovery	All samples within limits
Duplicate Analyses (All samples)	< 25% RPD	All samples within limits

6.2.4.6 PCDDs/PCDFs

Evaluation of the validity of the PCDD/PCDF data resultant from the analysis of the Method 0023A sampling train samples was based on the following criteria:

- Recoveries of internal, pre-spike and alternate recovery standards added to the samples prior to sampling or sample extraction.
- Results of analysis of an LCS / LCSD for the 17 PCDD/PCDF isomers listed in EPA Method 0023A.
- Results of analyses of field and method blank samples.

On the basis of the QC results summarized in **Table 6-8**, no sample analyses were rejected, and all data were determined to be valid.

Table 6-8 Overall QC Summary for PCDDs/PCDFs in Stack Gas Samples

QC Parameter	Target Criteria	Program Results
Field Blank	Below detection limit	ND for all but one (OCDF) of 17 congeners
Method Blank	Below detection limit	ND for all but one (OCDF) of 17 congeners
LCS / LCSD	70 – 130% recovery	All congeners within limits
Accuracy for Internal Standards (IS) and alternate recovery standard (AS)	40 – 135% recovery	All labeled standards within limits. One slightly low recovery in the field blank, but S/N > 10:1
Accuracy for pre-spike recovery standards (PS)	70 – 130% recovery	All labeled standards within limits. One slightly low recovery in the field blank, but S/N > 10:1

6.2.4.7 PAHs

Evaluation of the validity of the PAH data resultant from the analysis of the Method 0023A/0010 samples was based on the following data quality objectives:

- Recoveries of internal standards and an alternate recovery standard (added prior to sample extraction) and surrogate pre-spike standards (added prior to field sampling).
- Results of analysis of two lab control samples for the 19 compounds listed in CARB Method 429.
- Results of analysis of field and method blank samples for all target analytes.

On the basis of the results presented in **Table 6-9**, no sample analyses were rejected, and all results were determined to be valid. Completeness was therefore determined to be 100% for all results from the Method 0010 trains submitted for PAH analysis.

Table 6-9 Overall QC Summary for PAHs in Stack Gas Samples

QC Parameter	Target Criteria	Program Results
Field Blank	Below detection limit	ND for all but two of 19 target analytes. Not deemed significant since quantities were < 5% of highest levels observed in actual samples.
Method Blank	Below detection limit	ND for all but two of 19 target analytes. Not deemed significant since quantities were < 5% of highest levels observed in actual samples.
Accuracy - Lab Control Samples	50 – 150% recovery	All target analytes within limits
Precision - Lab Control Samples	Less than 50% RPD	RPDs observed were < 15%.
Accuracy for Internal Standards, Pre-Spike Recovery Standards and an Alternate Recovery Standard	50 – 150% recovery	All labeled standards within limits except that low recoveries reported for several internal standards. However, S/N ratio for each of these low recoveries was greater than 10:1.

6.2.4.8 Target SVOCs

Evaluation of the validity of the SVOC data resultant from the analysis of the Method 0010 samples was based on the following data quality objectives:

- Assessment of recoveries for internal standards (added prior to sample extraction) and isotopically-labeled surrogate compounds (added prior to sample analysis).
- Evaluation of recoveries associated with over 40 representative SVOCs spiked onto multiple laboratory control samples.
- Results of media checks performed on the XAD resin and filter.
- Results of analysis of field and method blank samples for target analytes.

Results presented in **Table 6-10** show that overall data quality was good and completeness was therefore determined to be 100% for all results from the Method 0010 trains submitted for SVOC analyses.

Table 6-10 Overall QC Summary for SVOCs in Stack Gas Samples

QC Parameter	Target Criteria	Program Results
Field blank – All Sample Fractions	Below detection limit	All analytes below detection limit
Method Blanks	Below detection limit	All analytes below detection limit
Accuracy – Spikes (LCS)	Different % recovery range for each of the compounds spiked	All recoveries within specified limits, except low recoveries for aniline, benzoic acid and dimethyl phthalate
Precision – LCS / LCSD	Different RPD goal for each compound evaluated. Target generally less than 40%.	All RPD values within specified limits
Accuracy – Recoveries for Internal Standards and Surrogates	Different % recovery range for each compound spiked	All but one surrogate recovery within limits
Media Checks	Below detection limit	All analytes below detection limit

6.2.4.9 Target Volatile Organics (Condition 2) and MCB (Condition 3)

Evaluation of the validity of the data resultant from the analysis of the VOST samples for volatile organics was based on the following indicators:

- Recoveries of 4 surrogate compounds added to the VOST samples prior to analysis.
- Replicate analysis of two traps spiked with standards (LCS samples).
- Separate analysis of the front and back VOST tubes for pair "a" of each VOST set to determine whether compound breakthrough had occurred.
- Results of analyses of field, trip and lab blank samples.
- Results of analysis of an EPA audit cylinder presented by DTSC.

Due to the fact that so little condensate was collected (~ 1 mL) over the course of each run, a decision was made to not have these samples analyzed. It is also noted that the C2-R3 pair "a" tenax sample was received broken. Numerous samples from Condition 3 were also received broken and therefore the lab was instructed to analyze all available VOST cartridges. Only 3 different compounds exhibited breakthrough and this was only during Condition 2. This occurred 3 times for acetone and once each for chloromethane and methylene chloride. None of the compounds observed in the blanks or that exhibited breakthrough are deemed to be significant as they are common solvents used in the field or in the lab. Based on the overall results summarized in **Table 6-11**, completeness was therefore determined to be 100% for all VOST analyses.

Table 6-11 Overall QC Summary for Volatile Organics in Stack Gas Samples

Condition 2 VOST Analyses --

QC Parameter	Target Criteria	Program Results
Field Blanks, Trip Blank and Method Blank	Below detection limit	No compounds detected above RL
Lab Control Samples	50%-150% recovery	All samples within control limits and good precision demonstrated (< 15% RPD).
Breakthrough Determination	TX/C trap should contain < 75 ng or < 30% of amount on TX trap.	Breakthrough observed for acetone (3 times), chloromethane (once) and methylene chloride (once)
Accuracy-Surrogate Recoveries	50%-150% recovery	All surrogate recoveries within limits

Condition 3 VOST Analyses –

QC Parameter	Target Criteria	Program Results
Field Blanks, Trip Blank and Method Blank	Below detection limit	No compounds detected above RL
Lab Control Samples	50%-150% recovery	All samples within control limits and good precision demonstrated (< 15% RPD).
Breakthrough Determination	TX/C trap should contain < 75 ng or < 30% of amount on TX trap.	No breakthrough observed for MCB
Accuracy-Surrogate Recoveries	50%-150% recovery	All surrogate recoveries within limits
Accuracy-EPA Audit Cylinder	50%-150% recovery	Results submitted to DTSC. Status of reported results unknown.

Appendix A

Facility Process Monitoring Data

Daily CEM Calibration Data

Detailed Process Data Summaries

Test Condition 1 (June 6, 2006)

Test Condition 2 (June 7-9, 2006)

Test Condition 3 (June 13, 2006)

Appendix B

Field Sampling Report
The Avogadro Group, LLC

Appendix C

POHC Spiking Report
Triad Chemicals, LLC

Appendix D

Field Sampling Documentation (ENSR)

Field Log

Field Data Sheets Associated with Waste Feed Stream Sampling

Detailed Listing of Sampling Parameters for All Test Conditions

Sample Shipment Documentation

Appendix E

Analytical Data Reports

STL – Knoxville

Waste Feed Analytical Results (Physical Parameters)

STL – Sacramento

Waste Feed Analytical Results (VOCs, SVOCs and Metals)

Enthalpy Analytical, Inc.

Carbonyl Compounds on Method 0011 Sampling Train

Alta Analytical Laboratories, Inc.

PCDDs/PCDFs and PAHs on Method 0023A Sampling Train

STL – Knoxville

Hexavalent Chromium on Method 0061 Sampling Train

STL – Sacramento

Target SVOCs on Method 0010 Sampling Train; Metals on Method 29 Sampling Train and HCl, Cl_2 and NH_3 on Method 0050 Sampling Train

Method 29 Metals Blank Correction Performed by ENSR

STL-Knoxville

Target VOCs (Condition 2) on Method 0030 Sampling Train

STL – Knoxville

MCB (Condition 3) and VOST Audit Results on Method 0030 Sampling Train

Shell Martinez- Trial Burn Report Conditions 3

Disclaimer- The attachments are not posted at this time due to their large file size. These are available through the DTSC project manager.